SCIENTIFIC AMERICAN

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A STEAM NAVVY.

The handwork of the "navvy" or navigator has of late years been superseded in many ways; and the invention illustrated herewith will further economize manual labor, as it excavates its own pathway through hills, and fills wagons with the removed earth or stone. Lines of rails are arranged for the wagons so that there is always a train of empty wagons standing on a central road behind the navvy, whence they are drawn over a short jump road into position on the side roads for filling, while the filled wagons run back from the machine on the side roads. The navvy illustrated is capable of excavating and filling into wagons at the rate of 60 cubic yards per hour, two men and one boy being required to work it.

This machine is constructed mainly of wrought iron, so as to withstand the heavy work that it has to encounter. The mode of working it may be briefly described as follows: The engine driver, who has the control of all the moving parts, is directed by the man who has charge of the scoop, and who stands on the circular platform at foot of the jib in front of the machine. When the jib is swung to the position required, the scoop is lowered till the mouth of it rests upon the ground. The man on the circular platform, by means of a foot brake and gear, holds the scoop in that position, so fixing the length of the scoop handle from a pivot or point on the jib. The scoop is now drawn forward by means of a chain and winding drum, thereby cutting all before it, according to the radius described by the length of the scoop handle. As soon as the scoop is filled, the man who has charge of it eases the foot brake, allowing it to come out of its cut. When lifted high enough, the jib is then swung round until the scoop is brought over the wagon to be filled; the attendant now by means of a trigger line draws the spring catch bolt, allowing the hinged bottom to drop down, discharging its contents into the wagon. The jib is then swung round again, the scoop lowered, and the operation repeated.

After the machine has excavated all that is within its reach, the anchor screws are slackened off, extra sleepers with a short length of rails are then laid down in front of it, and by means of the propelling gear it is moved forward the required distance. The anchor screws are then screwed down in order to prevent the machine from slipping back when at work.

We are indebted to *Engineering* for the engraving and description of this machine, which is the joint invention of Messrs. Dunbar and Ruston.

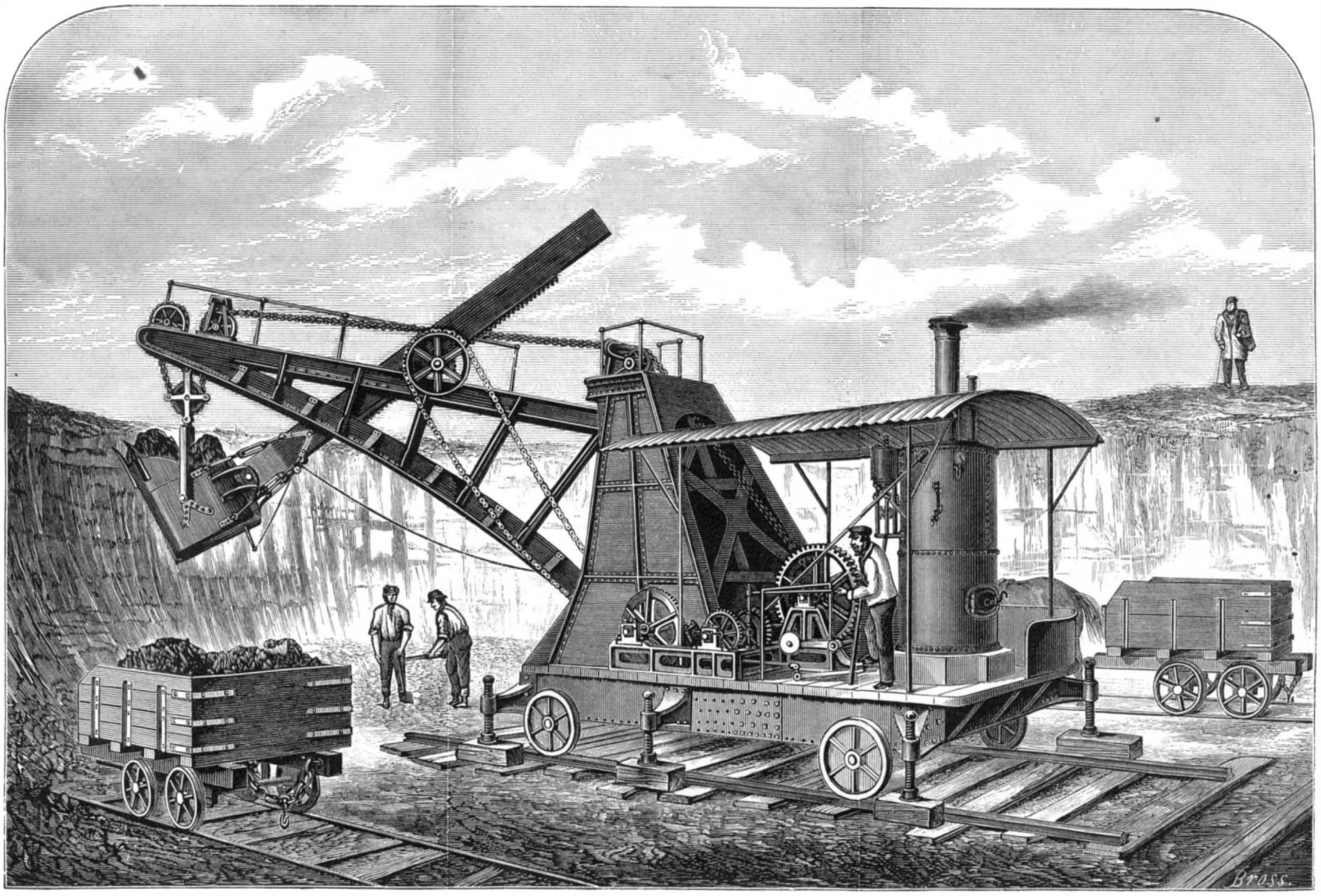
Detection of Adulteration in Butter.

Artificial butter seems at present to be attracting even more attention in Europe than here. R. Godeffroy, of Vienna, after describing its manufacture, remarks that artificial butter has a pale yellow, perfectly homogeneous appearance, does not taste the least bit like tallow or otherwise disagreeably, and melts in the mouth just like real butter. It differs from the latter in lacking the flavor characteristic of the real butter, by its lower melting point, by its smaller percentage of water, and by having a smaller amount of caseous matter, insoluble in ether.

According to Boussingault, rightly made, well washed, and well dried artificial butter contains 13 to 14 per cent of water, while the ordinary market butter of Paris contains from 18 to 24 per cent of water. Moser found only 6·4 per cent of water in artificial butter; but in the market butter of Vienna he found from 14·9 to 20·1 per cent of water.

In pure butter Boussingault found 3·13 per cent of caseous matter, insoluble in ether, and in artificial butter only 1·2 per cent. Moser found that artificial butter melts at 28° C. (82° Fah.), while genuine butter melts at 33° to 36° C. (92° to 96° Fah.). He believed that the melting point furnished a quick and easy method of distinguishing the artificial from the genuine. For this purpose it does indeed offer a certain and not-to-be-despised means of distinction; but it fails to detect the mixture of the two. For the latter purpose, no certain and easy method has yet been found. Angell and Gatehouse have indeed described certain methods of doing this; but they are in part roundabout and circumstantial, in part insufficient. O. Kunstmann recommends that the butter be drawn up by a piece of wick ⅛ inch wide, and lighted; after burning 1 or 2 minutes, let the flame be blown out, and the odor of the smoke and vapor ascending from the wick noted. It is easy to tell by the odor whether the butter is pure or adulterated; but the odor of the vapor is less intense when the butter is adulterated with lard than when tallow has been employed as the adulterant. Dr. O. Bach gives a simple method of butter analysis based on some of the above properties. The only apparatus required are a thermometer and a test tube. In the latter is placed 3 volumes of ether and 1 volume alcohol of 95°. About 15 grains of butter are put into 20 times this quantity of the alcohol and ether mixture, and the test tube placed in water heated to 20° C. (68° Fah.). If the room is heated to this temperature, the warm water is of course unnecessary. At this temperature pure butter is completely dissolved; the salt remains and settles, and its quantity can be estimated from its bulk. The small amount of caseine which is present in pure butter is mostly attached to the sides of the tube; all else is in solution. Butter adulterated with lard, beef tallow, or mutton tallow leaves the latter undissolved at the above temperature; and if the quantity exceeds 10 per cent it is easily recognized. If the butter in question contains less of the foreign fats, it is only necessary to cool the test tube in a stream of water without permitting any water to enter the tube, when the liquid will become turbid from precipitation of the fat. A solution of pure butter can be cooled without getting cloudy. This method is so simple that persons who are not chemists may employ it.

ARTIFICIAL flowers called barometers are being now exhibited in a number of Parisian opticians' shops. They are colored with a material composed of chloride of cobalt. When exposed to sun and dry air the leaves become deep blue; when the air is saturated with moisture they become pinky. All the intermediate shades are easily observed.



DUNBAR & RUSTON'S STEAM NAVVY.

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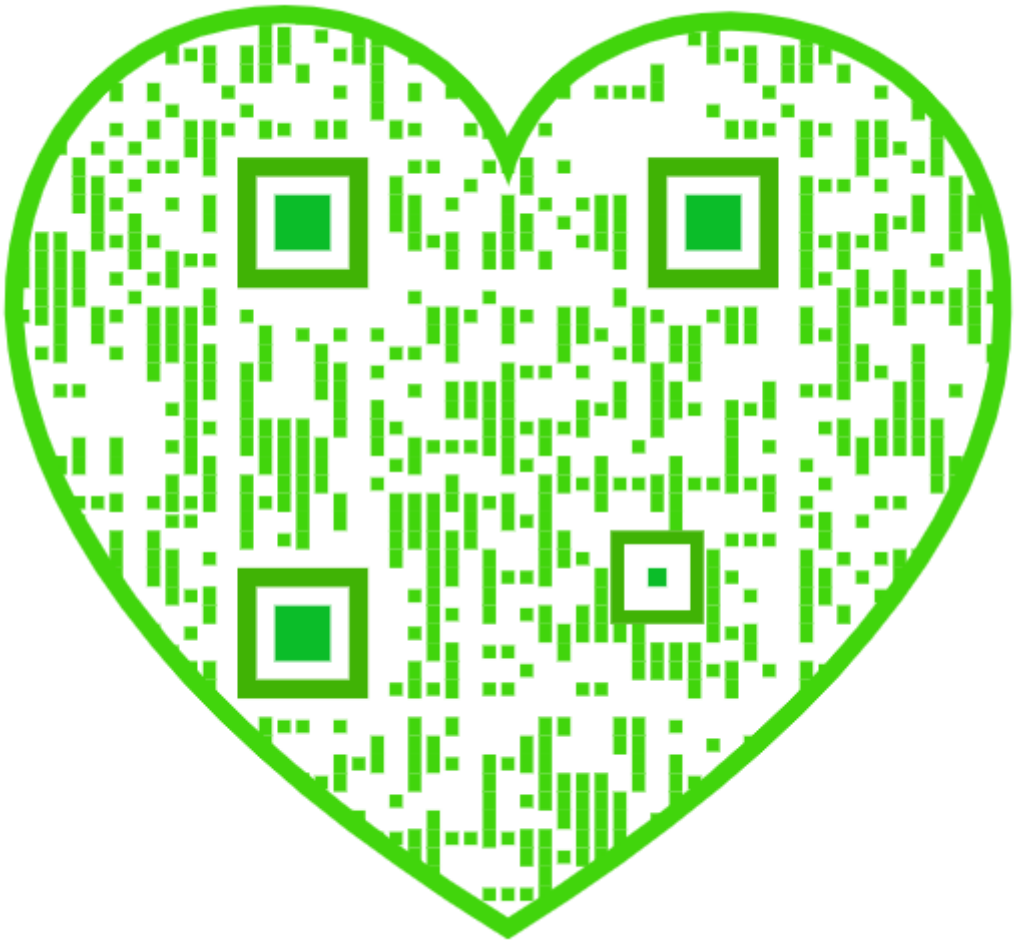

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NEW YORK, SATURDAY, JUNE 30, 1877.

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THE LIMITS AND POWERS OF VISION.

Delicacy of vision is due to two causes: sensitiveness of the retina, which allows of the perception of minute differences of light, or, in other words, of the clear definition of objects illuminated very slightly more or less than the background against which they appear; and the perfection of the different portions of the eye itself, which admits of the perception of very small objects, or of separating those nearly approximated without the images becoming confused through irradiation. Dr. Carpenter states that the smallest particle of a white substance distinguishable by the naked eye upon a black ground, or of a black substance upon a white ground, is about $\frac{1}{400}$ inch square. "It is possible by the closest attention," he continues, "and by the most favorable direction of light, to recognize particles that are only $\frac{1}{840}$ inch square, but without sharpness and certainty. But particles which strongly reflect light may be distinctly seen when not half the size of the least of the foregoing. Thus, gold dust of the fineness of $\frac{1}{1125}$ inch may be discerned with the naked eye in common daylight. When particles that cannot be distinguished by themselves with the naked eye are placed in a row, they become visible, and hence the delicacy of vision is greater for lines than for single particles. Thus, opaque threads of more than $\frac{1}{4900}$ inch across, or about half the diameter of the silkworm's fiber, may be discerned by the naked eye when they are held towards the light."

Professor Mayer, in the first of his admirable papers on the "Minute Measurements of Modern Science," now appearing in the SCIENTIFIC AMERICAN SUPPLEMENT, states that by actual experiment he has determined the limit of visibility of the minute to be exemplified by a disk $\frac{1}{300}$ inch in diameter and a line about $\frac{1}{6000}$ inch in breadth. The same authority has found from several measures that a line $\frac{1}{1000}$ inch in breadth is obtained by drawing the finest line possible on Bristol board with a sharply pointed H H H pencil.

In general, in order to distinguish clearly a dark object on a light ground, or the reverse, it is necessary that the object subtend an angle of at least one minute. But this again is dependent upon accidental and often personal conditions. Gassendi, the astronomer, was unable to perceive with the naked eye (protected only by smoked glass) solar spots subtending angles of 80 seconds; while other astronomers have, by practice, acquired the power of distinguishing spots of 50 seconds in diameter.

On a clear moonless night, every one possessing average powers of sight is capable of discerning stars of the sixth magnitude. There are, therefore, at any time two thousand stars visible above the horizon, or about four thousand over the entire heavens. But under very favorable circumstances and in the absence of all other light (reflection of terrestrial lights, zodiacal light, twilight, etc.), when the atmosphere, cleansed by recent rain, is very moist and the stars seem exceptionally brilliant, heavenly bodies between the sixth and seventh magnitude are also discernible by the naked eye. The contrast due to the apparent extinction and apparition of the smallest stars, a phenomenon due to their twinkling, allows of their being momentarily perceived, especially by the parts of the retina a little to one side of the direct point of formation of the image, as these parts are usually more sensitive on account of their not being normally used for visual purposes. Under these conditions, persons whose sight has become acute through repeated observations are able to see, in the entire heavens, some eleven thousand stars, this aggregate having been determined by the astronomers Heis, at Munster, and Gould, at Cordova.

It is ordinarily possible to see six stars in the Pleiades; some people can distinguish seven. Heis has counted ten, Denning at Bristol saw thirteen, and Moestlin, Kepler's preceptor, saw fourteen. Mr. Heis possesses both the qualities of delicate vision above noted in a remarkable degree. In full sunlight he has perceived Venus, Jupiter, and Mercury; and at night, when the moon was absent, he saw Vesta and Uranus, with the unassisted eye. So clear is his sight that he is at all times able to separate the two neighboring stars of η of the Great Bear, and also those relatively distant 6′ 30″ known as α in Capricornus. When the sky is very clear, he has resolved ν of the Scorpion, δ of the Lyre, and ε of the same constellation, of which the stars are distant but 3′ 27″.

There are, however, well known cases of even more wonderful feats of vision. The difficulty of perceiving the satellites of Jupiter is enormous because of the great brilliancy of the planet and the nearness of the satellites. The first of the latter is distant but two and a quarter minutes, and the fourth nine minutes and three quarters. They vary in brilliancy from seventh magnitude downward, so that in any event they are radically invisible to the average naked eye. The third satellite is the largest and brightest, and hence this one is most frequently seen, although Heis, with all his wonderful powers, has never accomplished its perception. Jacob, however, saw it at Madras, and Buffham and Mason in England. Boyd saw both the second and third satellites separate and distinct in 1860, and Denning perceived the third and fourth, in 1874, by masking the bright face of the planet. Schoen, a tailor of Breslau, perceived the first and third satellites at the time of their greatest elongation. These are the most difficult to separate, owing to their proximity to Jupiter.

Probably the most difficult feat of all recorded done by human sight is the perceiving of the crescent of Venus. This has been done but three times, once by Stoddard, a missionary on the high table lands of Persia, once by Theodore Parker when a child in Chili, and once by Abbé André, in 1868, in France. The Abbé saw the crescent when it subtended an angle of but fifty seconds.

TRANCE.

Whether his particular theories and opinions do or do not hold strictly correct when gauged by more extended future investigation, Dr. George M. Beard, of this city, is doing capital work in directing the light of purely scientific inquiry upon that host of psychological delusions, which occupy a vaguely defined suppositious borderland of science. It is hard nowadays for any thinking person to view with equanimity the miserable deceptions which are imposed, not upon the obviously ignorant, but apparently upon the most enlightened portion of the community. College professors, to whom we look for the careful training of young minds, have lent themselves to the serious consideration of the absurd performances of a self-styled mind reader. A person of morbid intellect was recently enabled in this city to inflict a room full of sensible people with a lecture replete with the profoundest nonsense, through the wholesale publication of an invitation apparently signed by some of our foremost citizens. Blue glass panes, dotting the windows of scores of the finest mansions, attest the fact that a popular delusion is by no means confined to the presumably educated. "The outcome of two thousand years of human learning since the foundation of the science of logic by Aristotle," says Dr. Beard, "is that the *Encyclopædia Britannica*, in its latest edition, regards it as an open question whether ghosts appear." In short, even if the majority of people do not absolutely acquiesce in a modern form of superstition or delusion, they declare with Emerson that all these claims are mysteries of which a wise man would prefer to be ignorant. Credulity, then, on one hand, ignorance on the other, whether self-imposed or not: these are the mental states, which generate a third, wherein a reasoning being bids farewell to his reason, wherein a logical mind becomes illogical, and doubt, surmise, and deception reign unchecked.

Dr. Beard has made an especial study of the symptoms connected with the nervous system, whereon are based the superstitions known as mesmerism, animal magnetism, hypnotism, etc. As the result of his investigations, he propounds the theory that "trance is a functional disease of the nervous system, in which the cerebral activity is concentrated in some limited region of the brain, with suspension of the activity of the rest of the brain and consequent loss of volition." From this hypothesis, he deduces explanations of all the various phenomena which have been ascribed to the causes above detailed. For the sake of convenience, trance is divided into four varieties: the spontaneous, the self-induced, the emotional, and the intellectual trance. A typical form of the first is natural somnambulism or sleep-walking, in which, "the cerebral equilibrium being spontaneously disturbed through the subjective action of dreams, the subject, under the dominion of a restricted region of the brain, the activity of the rest of the brain being suspended, runs and walks about like an automaton. Under self-induced trance are comprised those cases where the subject can bring himself into this state at will, either suddenly or gradually. This can be accomplished by low living, approaching nearly to starvation. Emotional trance, which includes by far the larger number of cases, may be induced by fear, reverence, wonder, or expectation, exerted to such a degree that the activity of the brain is suspended, while these emotions are abnormally active, and consequently the will loses control and the subject acts automatically in response to external or internal suggestion, doing the very things he wishes to avoid doing, and being unable to do what he desires. It is of no consequence in what manner this trance is produced; it is purely subjective, and depends wholly upon the emotions of the subject. The mesmeric operator or medium has really nothing to do with the physical effect produced; it is only necessary that the subject believe in him. To intellectual trance belong the extreme cases of absent-mindedness. A large portion of the brain is active, and, until aroused, is insensible to surroundings and responds automatically to external suggestions or influences.

We cannot here follow Dr. Beard in detail through all the phenomena of trance to which he shows that his theory can be fitted. Some of his explanations are exceedingly ingenious, and merit study; and the simple simile, which he offers to realize his distinction between sleep, trance, death, and normal waking state, is quite happy. "When all the burners of a chandelier are fully lighted," he says, "that is the normal waking state; when all of the burners are turned down low but not turned out entirely, that is ordinary sleep; if I turn out entirely all the burners except one, and that one, as often happens, flames all the more brightly from increased pressure, that is trance; if all the burners are turned out entirely and permanently, that is death."

The application of the hypothesis to the singular phenomenon of double life—cases of which we have repeatedly noted—is perhaps the most interesting. In trance there is probably always consciousness at the time; but it is not always or usually remembered consciousness. On awaking, the dreams fade; but on resuming the trance state, the exalted functional activity of the region of the brain in which the cerebral force is concentrated is able to bring back these impressions of the previous attack of trance, forgotten during the intervening normal state. Thus the subject carries on an independent trance life. On returning to the normal state, the cerebral force, being again diffused, is insufficient to enable the subject to recall trance experience, but quite

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sufficient to enable him to recollect his normal feelings. Thus he leads two independent lives.

The direct consequence of Dr. Beard's theory is that it tends to reduce all such delusions as clairvoyance, spiritualism, etc., to one common basis of scientific hypothesis; but the indirect consequence seems to us to be fraught with much graver interest to society. The only deduction to be drawn is that there is more evidence of the irresponsibility of humanity, further proof of another state when man may be but an automaton. Last week we brought forward competent medical evidence to prove that a drunken man is as irresponsible as a lunatic. Here again is expert testimony to the effect that, under a host of other conditions, a person may become unaware of his own acts. If fear and excitement are powerful exciting causes for trance, and the person in the trance or near the trance state receives erroneous impressions, wherein is the value of evidences by eye-witnesses of crimes committed under circumstances of great fear or excitement? Testimony as to sudden accidents might be similarly viewed with doubt; yet on the other hand, if we admit irresponsibility in the entranced person, how are we to guard ourselves against deception? for, as Dr. Beard says, "nothing is easier to counterfeit, after slight practice, than the early physical symptoms of trance." We cannot but agree with our author in the view that the day for the examination of this subject by the average individual has gone by, and that the only reliable informant is the medical expert. We do not send committees of lawyers and clergymen to examine peculiarities in construction of buildings; how much less logical is it to ask them to comprehend the hidden phenomena of brain construction? We need something more than a report of what trustworthy men think they see; and that something is the testimony of experts who look to causes and not to mere visible effects.

THE BANIAN TREE.

Of the remarkable phases of vegetable growth, that of the banian tree is certainly the most astonishing. We have more than one running plant, which, like the wild strawberry, spreads around a central stem by dipping into earth its distant branches, and thus establishing subsidiary centers; and in the mangrove of our southern shores we may see a tree, of considerable height, dropping from elevated limbs a number of whip-like roots which penetrate the ground, often through a foot or more of water; then, reversing their circulation, they become true stems, capable of maintaining themselves when separated from the parent stock. But, even with these illustrations before us, it is hard to realize the appearance and life conditions of a wide-spreading communal forest, the connected outgrowth of a single tree.

The anomalous physiology of a mangrove or banian root stem we have never seen described. How is it that its character is so completely reversed? At first its growth is downward, by a true root-like increase of cell structure at its free end. It remains perfectly cylindrical throughout, without the slightest variation in diameter, until it branches in the ground. Up to this point its circulation is downward from the parent stem: but now all is changed. It ceases to be a root, and becomes a stem, growing and supplying its branches with sap like a tree trunk of ordinary growth.

The banian adds another strange peculiarity, namely, that it rarely sprouts from the ground, the crown of a palm being usually its starting place. The banian seed is dropped by some bird into the frond, or upper cluster of leaves of the palm, and, sprouting there takes root within the palm: this commonly when the palm is in its infancy. The palm grows upward, an unbranching column. The banian spreads outward and begins to send its root stalks downward from its branches; not diverted twigs, but special growths, true aerial roots. With this exception, Milton only describes without exaggeration, when he writes of this tree as

> "Branching so broad along that in the ground
> The bending twigs take root, and daughters grow
> About the mother tree, a pillared shade
> High over-arched, with echoing walks between."

Meantime the palm is pushing upward, embraced by the descending banian shoots, which become so interlaced in course of time that the trunk of the palm is wholly concealed. At this stage appearance flatly contradicts reality; the palm seems to be growing from the heart of the banian, as though a date seed had taken root in the banian top. Possibly the curious Hindoo custom of marrying trees of different species had its origin in, or was suggested by, these natural unions.

The banian (*ficus Indica*) is one of the great natural family the *urticaceæ*, to which our familiar stinging nettle also belongs. It bears a small red fig or berry, which in times of famine has afforded food for thousands. An instance of the vast extent of country which may be covered by a single-tree banian grove is furnished by the island of Nerbudda, which is entirely covered by one tree. A considerable portion of the island and the grove growing upon it has been washed away by river floods during recent years; but enough remains to make one of the noblest groves in the world. The natives boast that it once afforded shelter for a troop of 10,000 horses. Another extensive banian forest—all parts of one tree—occurs in the district of Beerbhoom, in Bengal. It covers "an immense extent of country," and overshadows more than four hundred temples.

The bride of the banian, in the ceremony above alluded to, usually the sacred *peepul*, or bo-tree (*ficus religiosa*). It is one of the latter that inspires such widespread reverence among Thibetian and other Buddhists, from the circumstance that its leaves bear well marked characters in their sacred language. That these characters are not the work of the priests who have charge of the tree seems to be well established. A couple of French missionaries who were permitted to examine the tree report their inability to discover the least sign of art in these mysterious—and to the Buddhists miraculous—markings. "We examined," they write, "everything with the closest attention, in order to detect some trace of trickery, but we could discern nothing of the sort; and the perspiration absolutely trickled down our faces under the influence of the sensations which this most amazing spectacle created."

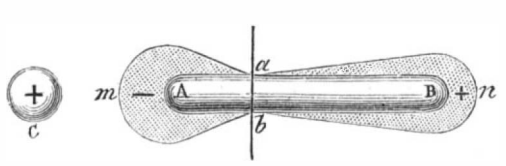
The mental attitude of these perspiring missionaries, when brought face to face with an alleged miracle that bore no evidence of trickery, is instructive. That the markings could be natural seems not to have occurred to them. Dr. Hooker, from his familiarity with Nature in India, was able to explain the miracle offhand with the single word "insects!"

VOLPICELLI'S NEW THEORY OF ELECTRO-STATIC INDUCTION.

An insulated conductor charged with either kind of electricity acts on bodies in a natural state placed near it in a manner analogous to that of the action of a magnet on soft iron, that is, it decomposes the neutral fluid, attracting the opposite and repelling the like kind of electricity. The action thus exerted is said to take place by influence or induction. The usual apparatus for demonstrating this hypothesis is a brass cylinder placed on an insulated support and provided at its extremities, or at various points along its length, with pith balls suspended by linen threads. If this arrangement be placed near an insulated conductor charged with either kind of electricity, the natural fluid of the cylinder is supposed to be decomposed, and free electricity is developed at each end, when both pith balls there located will diverge. The electricity of opposite character to that of the conductor goes to the end of the cylinder nearest that conductor, while electricity of the same kind as the conductor seeks the further extremity. There is a point on the cylinder where no divergence of the pith balls occurs, and this is termed the neutral point.

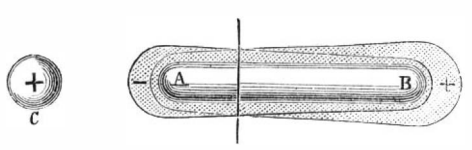
This hypothesis was, some thirty years ago, attacked by Melloni, who asserted that the imaginary electric fluid was not separated into its positive and negative components, but that both of the latter existed all over the cylinder, although, in point of quantity, there was more negative fluid on the end nearest the positive conductor and more positive fluid on the opposite extremity. The difference between Melloni's theory and that first noted will be clear from the annexed engravings. If the inducing source, *c*, Fig. 1, is positively electri-

Fig. 1.



fied, all the negative fluid of the cylinder, A B, according to the old hypothesis, goes to *a m b*, and all the positive fluid to *a n b*, *a b* being the neutral point. Melloni's idea is exemplified in Fig. 2, where both kinds of electricity exist in some degree over the entire cylinder. Melloni had scarcely more than reached a definite conclusion on this subject when

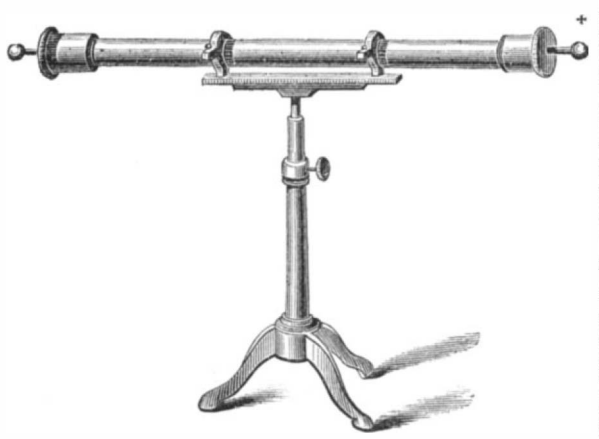
Fig. 2.



he died; but his work was taken up by M. Volpicelli, who for some twenty years has pursued the necessary investigations, and has recently announced conclusions confirming those of their original enunciator.

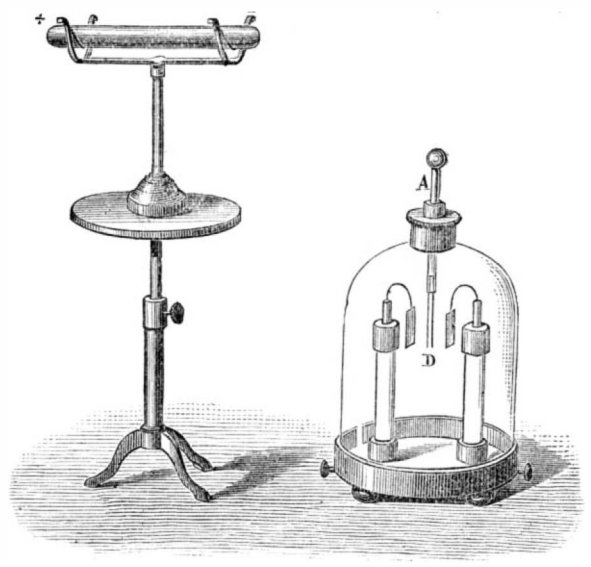
M. Volpicelli's apparatus consists of a large glass tube, 70 inches long, terminated by metallic armatures, and contain-

Fig. 3



ing a dry pile composed of 24,000 disks closely packed together and covered with a layer of copper on one face and of peroxide of manganese on the other (Fig. 3). This battery works uniformly for several months, and is a constant source of electricity. The body on which the induced electricity is developed is an ordinary glass cylinder, perfectly isolated by threads of raw silk, by which it is suspended in the crotches of a support (Fig. 4). The electricity rendered free by induction is taken on the cylinder by means of a little proof plane, which merits a special description; for the success of the experiments is largely dependent upon the excellence of the instruments used and the care with which all possible causes of error are avoided. The plane is composed of two small disks of copper, 0·35 inch in diameter, separated by a thin layer of insulating varnish. One of these disks is in communication with the soil by means of a metallic rod which is held in the hand. The other disk is fixed to a metallic rod terminating in an ivory ball, which slides freely in an opening situated in the middle of the first disk and in an eyelet carried by an annexed arm. In order to use the device, the two disks are brought into contact, and the movable disk is placed on the cylinder. The free electricity on the surface of the latter condenses on the disk, and may be transported to a distance, as, for example, upon the exterior armature of an electroscope, situated far enough away from the dry pile not to be influenced by it. M. Volpicelli also uses a proof plane consisting simply of a pin head. A portion of the end of the pin is cut off, and the rest inserted in a knob of sealing wax at the end of a metal handle. A Böhnenberger electroscope, containing improvements devised by M. Volpicelli, is also used. The two plates, towards which the gold leaves, D, are attracted when the exterior armature, A, is electrified, are supported by two glass columns containing dry piles analagous to those of the large inducing cylinder (Fig. 5). This electroscope has

Fig. 4. Fig. 5.



great sensibility. It might be termed a kind of electrical microscope.

In order to make the experiments, the insulated cylinder is properly placed in view by the electric source. It becomes electrified by induction. The free electricity on the cylinder is collected by the proof plane; and with the charge plane the electroscope is touched. The following phenomena then appear:

1. The free electricity found on the portion of the cylinder nearest the electric source is of the same character as that of the latter. This is diametrically opposite, of course, to the assertion of the old theory. The experiment may be repeated five or six times successively.

2. If the cylinder be placed in communication with the soil, so that the free electricity is allowed to escape, and the experiment with the proof plane be again tried, no sign of electricity is manifest.

3. If the cylinder be moved away from the electric source, so that the influence of the latter is diminished, and the proof plane be applied, the electroscope to which the latter is touched indicates an electricity of opposite character to that of the inducing body.

M. Volpicelli sums up the result of his investigations as follows: "Upon an insulated conductor submitted to the influence of an electrified body, electricity of opposite name possesses no potential. It is found in greatest quantity at the end of the conductor nearest the electrified body, and diminishes towards the opposite end. Electricity of the same name as that of the electrified body is found at all points on the insulated conductor, the end nearest the electrified source not excepted. It increases as it approaches the other extremity, and is always free." We extract our engravings from *La Nature*.

A New Projectile.

Mr. W. H. Lewis, a Welsh gentleman, of Hafod, near Swansea, has invented a new engine of warfare, which will be likely to attract considerable attention. It consists of a cannon, so arranged as to discharge a sharp sword-blade crosswise in the direction of the enemy, the knife or cutter being so poised in its career through the air as to cover the whole space in a longitudinal direction described by the blade itself. An 8-inch ball would carry a sword 14 feet in length 600 yards, literally mowing down every human obstacle in its path.

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MANUFACTURE OF THE HARVEY TORPEDO.

The Royal Arsenal at Woolwich, England, in which ten thousand hands are employed by Her Majesty's Government to fabricate the artillery and ammunition for land and sea service, has lately been producing different kinds of torpedoes, among them the Harvey torpedo, the manufacture of which is shown in a series of engravings presented this week, which we select from the *Illustrated London News*. It might be used with good effect, during the chase of one vessel by another of superior force, to give the former a chance of destroying its pursuer. The torpedo is encased in a wooden chest, which is buoyant, and can be set afloat by lowering it from the ship's deck with a windlass; after which, by the aid of a rope and one or two cork buoys, if required, it can be placed so as to drift or keep in the position for coming into contact with the enemy's ship. There is a lever projecting from the top of the chest at one end, which will descend immediately on being struck or pressed by the hull of the vessel to be destroyed; this lever sets in motion, at once, the mechanical apparatus attached to the percussion bolt, which is charged with detonating powder. The torpedo charge of gunpowder is thereby ignited, and it is highly probable that a large hole will be made in the ship's side or bottom, causing her to sink without any more trouble. Our illustrations show only the processes which may be witnessed by ordinary visitors to the Royal Arsenal. The interior construction of the torpedo, and the machinery connected with its percussion bolt, are not revealed to public inspection. Workmen are seen engaged in making the outer case and its fittings, the metal cylinder of the percussion bolt, and the cork buoys to serve in the practical application of this maritime weapon. The last-mentioned operation is also illustrated by one of our engravings. The torpedo in question was invented by Commander Harvey, R.N.

Testing Beer for Starch Sugar.

It is sometimes desirable to ascertain whether to a given sample of beer there has been added, for the purpose of economizing the malt, a substance variously known as artificial grape sugar, starch sugar, or potato sugar, etc., which is made from potato starch. Some time since, Béchamp made the discovery that this starch sugar contained a peculiar substance, intermediate between real sugar and dextrin, to which he gave the name "amylin." Like real grape sugar, it turns the ray of polarized light to the right; but unlike it, it is incapable of fermentation.

Eugen Dietrich has recently made the discovery that amylin is a crystalloid, and therefore able to pass, when in solution, through a dialyser made of parchment. This furnishes a ready method of separating it from dextrin, which is a colloid and unable to pass through the dialyser, The method of analysis as applied to beer is as follows:

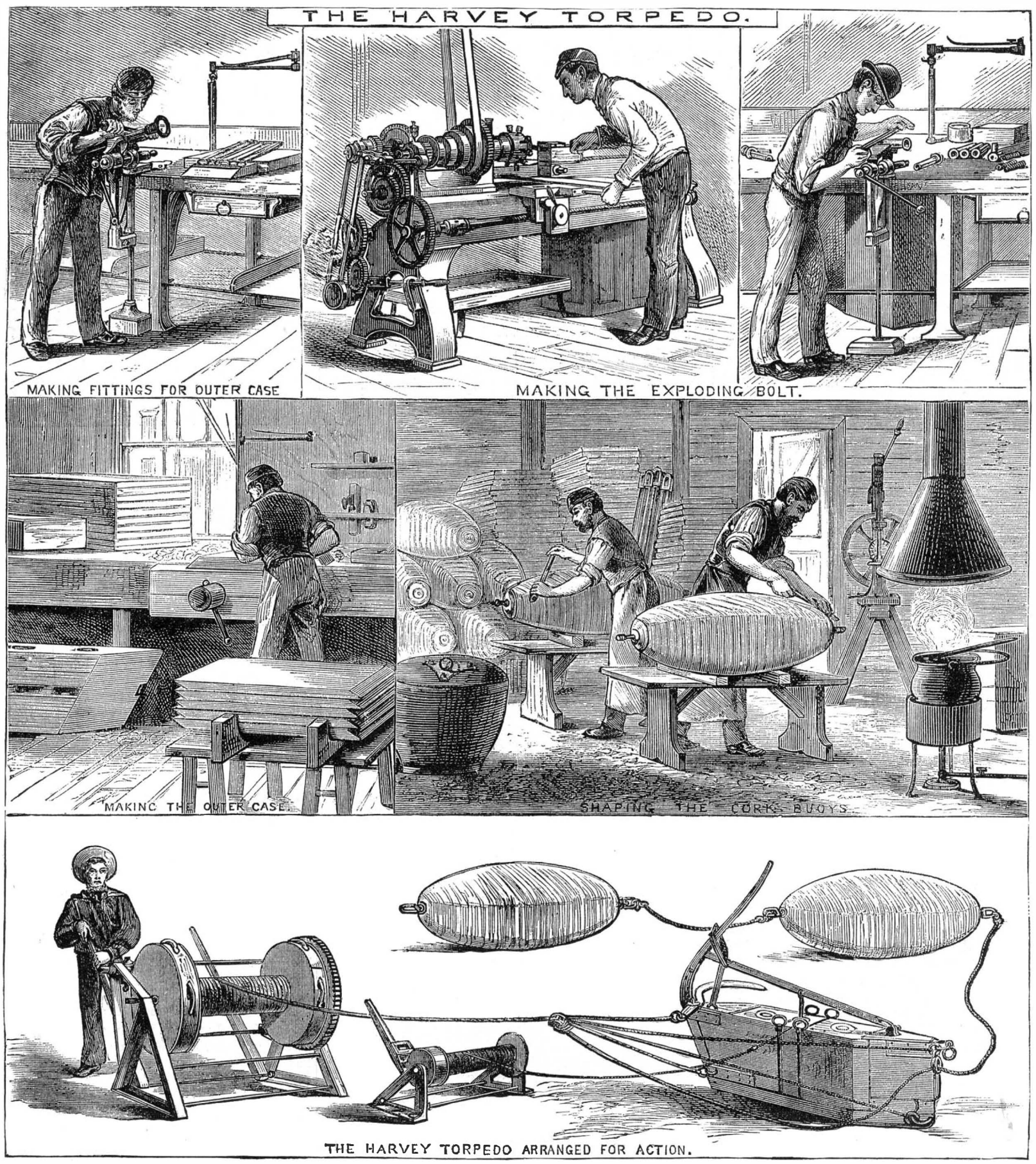
One liter ($\frac{4}{5}$ quart) of beer was subjected to dialysis for four days, water being frequently added. The dialysed liquid was evaporated to one quart, decolorized with animal charcoal, and filtered. Washed yeast was added to the filtrate, which was quietly left to itself at a temperature of 68° Fah., and in two days no further evolution of carbonic acid was perceptible. To make certain that all the sugar had been removed, fresh yeast was again added, left two days more, and the liquid filtered and polarized. According to Neubauer's experiments, commercial starch sugar contains 20 per cent of this non-fermentable substance. Hence we may conclude that the quantity of amylin found, when multiplied by 5, will give approximately the quantity of starch sugar employed. But 1 lb. of this sugar will replace on an average 2½ lbs. of malt, thus indicating the amount of malt saved.

Dyeing Cloth Black.

We dissolve for 50 lbs. of cloth, 2 lbs. of bichromate of potash; 1½ lbs. cream of tartar, and 3 lbs. of sulphuric acid in river water; we heat to a boil, and introduce the wool, which is let stop for one hour. The dye beck is composed of 35 lbs. of logwood, 2 lbs. of peach wood, 1 lb. of fustic; these woods are inclosed in sacks, and kept for 2 hours, before dyeing, in the necessary quantity of boiling water. The dye beck receives besides 2 lbs. of sulphate of indigo, and 1½ lbs. of sulphuric acid. We put the wool in this beck, which is raised afterwards to a boil for 1½ hours, washed and dried.—*Vict. Preston, in Dingler's Journal.*

Without a Rival.

"The SCIENTIFIC AMERICAN, published by MUNN & Co., New York city, is without a rival as a scientific paper, and to the mechanic is simply invaluable, We honestly believe any mechanic would derive information from a year's reading of the SCIENTIFIC AMERICAN which any amount of money could not buy elsewhere. Some of our enterprising citizen mechanics, we hope, will try the experiment of reading this really valuable and practical journal one year. We know," says the Glasgow (Ky.) *Weekly Times*, "they would never give it up."


THE HARVEY TORPEDO.
MAKING FITTINGS FOR OUTER CASE
MAKING THE EXPLODING BOLT.
MAKING THE OUTER CASE.
SHAPING THE CORK BUOYS.
THE HARVEY TORPEDO ARRANGED FOR ACTION.

TORPEDO MANUFACTURE AT WOOLWICH, ENGLAND.

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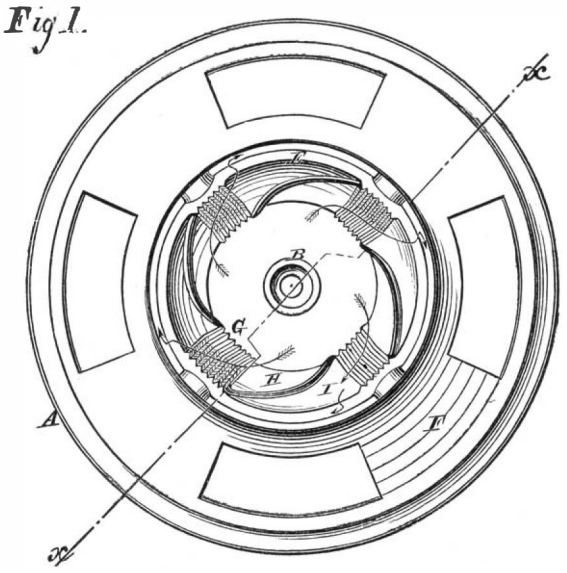
IMPROVED PAPER-PULP ENGINE.

The new feature in the engine illustrated herewith consists in the female cone, provided with groups of radial knives and guide cavities in the spaces between said groups of knives.

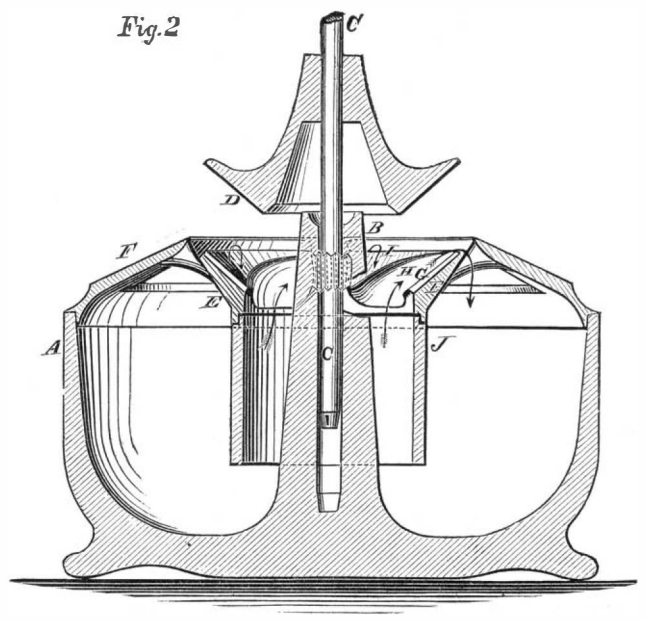
Upon the bottom of the case, A, is formed a hollow column, B, to receive and serve as a bearing for the vertical shaft, C, and which rises a little above the top of the case, A, to prevent the pulp from coming in contact with the shaft, C, and clogging and wearing it. To the shaft, C, above the top of the hollow column, B, is attached the hub of an inverted frustum of a cone, D. The lower part of the hub of the cone, D, is recessed to receive the upper end of the hollow column, B, so that the face of the male cone, D, may coincide with the face of the female cone, E.

Fig. 1.



To the face of the cone, D, are attached radial knives, not shown in the drawings. To the face of the cone, E, are attached knives, G, which are arranged in groups, and are made with an angle or curve, as shown in Fig. 1, to prevent them from interlocking with the knives of the cone, D. In the face of the cone, E, between the groups of knives, G, are formed two concavities, H I. The concavity, H, leads up from the lower edge of the cone, E, to the front of the group of knives, to serve as a spout to conduct the pulp to said knives; and the concavity, I, leads from the rear of the group of knives, G, to the upper edge of the cone, E, to serve as a spout to conduct the pulp from the knives to the upper edge of the cone, E, so that it may pass freely back into the case or tank, A. To the lower edge of the cone, E, is attached the upper edge of a tube, J, which extends down nearly to the bottom of the case, A. With this construction, the centrifugal force engendered by the revolution of the cone, D, causes the pulp to pass up between the cones, D E, flow over the upper edge of the cone, E, and flow back into the tank, A, the pulp from the lower part of the said tank passing into the tube, J, and up between the cones, D E, so as to establish a circulation, and insure all the pulp being properly acted upon. This invention was patented through the Scientific American Patent Agency, April 17, 1877, by Mr. J. S. Warren, of Cumberland Mills, Westbrook, Me.

Fig. 2.



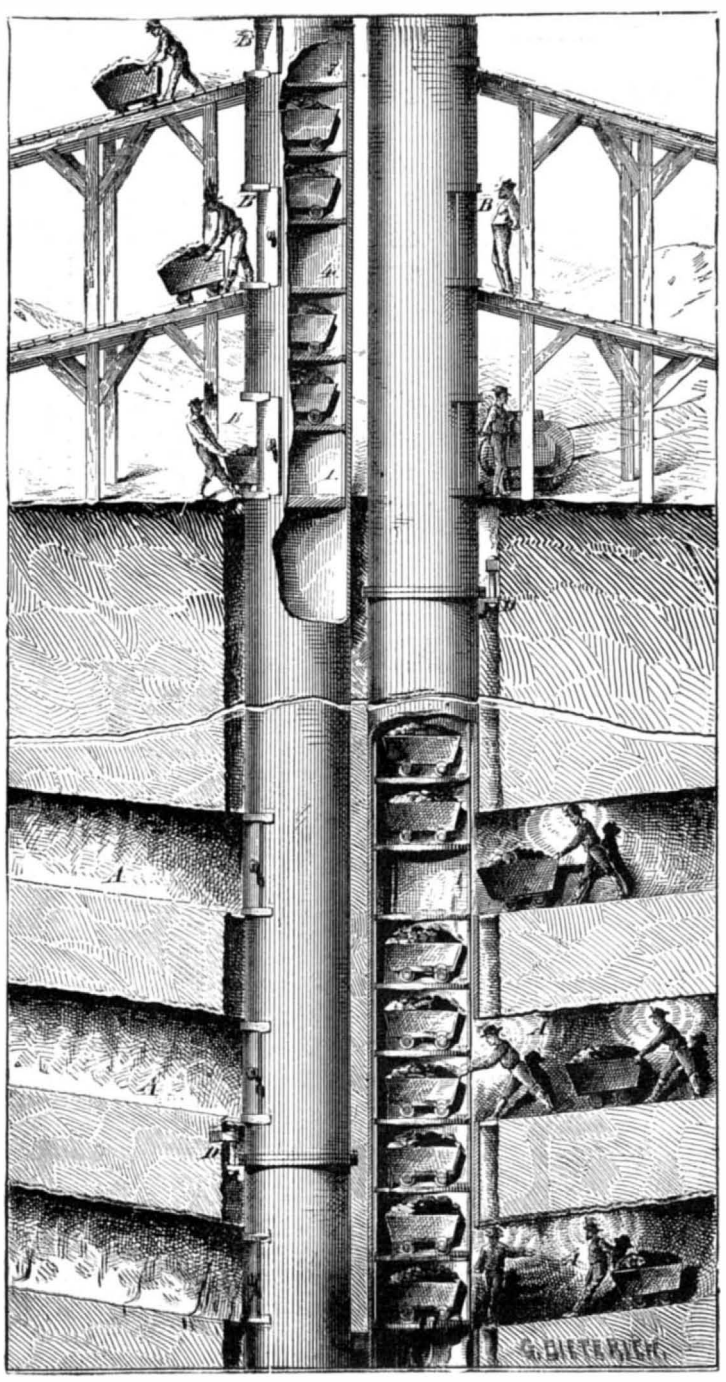
WARREN'S PAPER-PULP ENGINE.

PNEUMATIC ELEVATION IN MINES.

M. Blanchet has recently constructed, at Epinac, France, an atmospheric elevator which appears to be an important improvement in means of lifting the products of mines to the surface. The shaft of the mine is lined with an iron tube of about 1,920 feet in length, through which a load of 22,000 lbs. can be lifted. A vacuum is produced above the piston which supports the cage, which is thus carried up the tube by the normal atmospheric pressure acting from below. After the load is removed, the piston is allowed to descend slowly by its own gravity, sufficient air being admitted above it. Compressed air is not used to force the piston upward, on account of the heat necessarily developed by its compression being objectionable; and further, because pressure from within the tube tends to open any little fissures which may exist, while on the other hand pressure from without (which obtains when there is a vacuum within) serves to close them.

The charge to be elevated by M. Blanchet's apparatus is, as above stated, 22,000 lbs., and the piston has a diameter of 5·1 feet. The weight is therefore about 7·2 lbs. per square inch, so that but a partial vacuum is required above the piston. A manometer placed on the upper part of the tube indicates the condition of affairs within the shaft very clearly. In case the piston, in rising, encounters inequalities in the tube, so that its movement is stopped or delayed, the air pump, continuing its work, increases the vacuum, and allows a greater degree of atmospheric pressure to be exerted to push the piston past the obstacle. This change in the interior atmosphere is of course instantly shown by the manometer needle. The annexed engraving clearly exhibits the arrangement. At A are the various headings and galleries, which meet the shaft, and from which the filled receptacles are placed in the cage. At B are the openings above for removing the load. The doors at these upper apertures are kept closed during the ascension of the cage, and are not opened until the latter reaches the end of its upward journey. It will be observed that the cage contains nine tiers of receptacles, while there are only three receiving apertures above. The latter are, however, spaced apart a distance of about 10·5 feet, this being the height of three tiers of receptacles. Hence, after the cage has reached the summit, but three filled buckets or cars can be removed at a time, and three successive lowerings are necessary to bring the whole nine before the openings. The reception is accomplished as follows: The operator permits the cage to rise above the doors, and then closes the tube beneath them by a horizontal trap. The cage is thus prevented from falling, in case of any inopportune admission of air or accident to the machinery. Communication between the tube and the air pump is next closed, and a valve is opened, which allows air to enter very gradually above the cage. The latter then slowly descends. If the descent be too rapid, it is checked by closing the air valve or opening communication to the pump by means of a secondary small tube. By managing the two levers governing this apparatus, the cage is permitted to move down until tiers of buckets (Nos. 1, 4, and 7) are in front of the openings. Other levers are then manipulated, which cause wedges inside the tube to obstruct the further passage of the piston. In this way the cage is held motionless, so that no nice adjustment of difference of pressure need be looked to: although this is naturally so delicate that it is perfectly easy to stop and hold the cage anywhere in the tube without having recourse to the wedges. When the three filled receptacles above noted are removed, the operator withdraws the wedges, and permits the cage to sink until the second and then the third tier of receptacles comes in place. Then the trap is opened, and the cage without its load, now weighing some 11,000 lbs., is allowed to sink to the bottom of the tube. Just before it reaches this point, the air escape is cut off, so that the piston cushions on the slightly compressed air before it. The nine empty receptacles are then removed in the manner already described, three at a time.

M. Blanchet proposes soon to construct a second atmospheric tube, as shown in our illustration. The two cages will then travel in relatively opposite directions, and the work of the air pump will be diminished, the weight of one cage counterbalancing that of the other. The shaft is divided into two equal portions by a partition, one tube being in each compartment, while, in a third, an ordinary rope hoisting system may be arranged to serve as an auxiliary means of extraction. At D, in the illustration, is shown how the various sections of the tubes are connected. It will be noticed that the weight of the several portions is not borne by the parts directly underneath, else the weight of the immense column might cause its deflection. Each section is supported by eight rods, which are secured to horizontal timbers imbedded in the rocky sides of the shaft. Within the tube also are four longitudinal guides attached to its inner surface, which serve to prevent the rotation of the cage, so that the ore or coal receptacles are always brought in proper position before the doors.



BLANCHET'S PNEUMATIC ELEVATOR.

A New Resin--Kauri Gum.

We have recently met with a new vegetable product of peculiar origin and properties, the classification of which for some time was very puzzling until we made the acquaintance of a gentleman who was quite conversant with its appearance and sources. He at once pronounced it to be kauri gum, which is exported in some quantity from New Zealand. The physical properties of the gum were so different from those of most resins that we were led to try some experiments with it, which, though not entirely encouraging, may be here given to serve as a guide for those who choose to essay further trials of its usefulness from a photographic point of view. In appearance it is most like amber, which, also, in many other respects, it resembles. It is very similar to it in color, or one may say colors, for it is found in all the hues of amber, from the pale straw to light brown, and mingled also with cloudy-looking masses like clouded amber. It breaks with a lustrous fracture in the same manner as amber, but it is not so tough, and is consequently more fragile. Like amber, also, it is in a manner allied to fossil products; for, instead of being collected from growing trees, it is dug out of the ground on the site of old forests long laid low, and almost even with the ground—almost, but not quite, even; for to the little inequality on the surface of the broad, open ground, where the giant trees have fallen, does the gum hunter owe the power to find the hidden treasures of kauri gum. It is supposed that, possibly many centuries ago, conflagration of the *ti* tree scrub had destroyed the gum-bearing trees, which fell where they stood, half incrusted with the hardened sap, and according to their condition yielding small flakes or huge masses of sap, as the heated ground around them caused every particle of the resin to come to the surface. To find the gum, the heaps or mounds alluded to—which are covered with long grass and often scarcely discernible—are pierced by a steel-tipped spear which is carried for the purpose. A little practice soon enables the gum digger to discover if he has struck, not "ile," but gum. The experienced man then soon bares the spot, and finds pieces of the amber-looking material in blocks of various sizes, from a few ounces to half a hundredweight. This digging, which affords a means of livelihood to a large number of natives and colonists, known as "gum diggers," is also undertaken by the sheep breeder in his leisure moments, and to the small holder often, if luck favors him, forms a not unwelcome increase of income. It is collected and sent to market for shipment, and in England it appears to find purchasers who use it for the purpose of dressing calicoes with, for which object it is possibly dissolved by the aid of alkalies.

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To return to the physical properties of the material. In its peculiarities of solution it acted more like copal; like that gum it is difficultly soluble, and further experiment may show still further likeness. One remarkable characteristic of copal is its power of becoming more soluble in alcohol after first melting it with as little heat as possible, when, upon resolidification, it is found much more easily soluble. We have not yet tried whether the kauri would act in a similar manner, but shall do so shortly. So far we have tried its solubility in alcohol, chloroform, benzole, and turpentine.

In alcohol it is quite insoluble after a week's digestion, a little coloring matter only being taken up. In chloroform it is soluble to a great extent—a small proportion, after repeated shakings during the course of a week's digestion, appearing to refuse to dissolve. In benzole it is partially soluble, though not nearly to the extent of the chloroform solution. In turpentine its solubility appears to lie between benzole and chloroform.

In all the three last cases a portion only of the gum dissolves, leading to the supposition that it may be composed of a series of different and distinct resins having preferential solubility in the various menstrua. Upon trying the varnishes thus produced upon negatives they all gave a beautiful glossy film, not easily scratched through so as to reach the glass, but very easily rubbed upon the surface, as though something of the nature of beeswax might be contained in the substance dissolved. The varnish with turpentine had a decided advantage over the others in tenacity.

Up to this point they are all, therefore, decidedly inferior to shellac as a photographic protective varnish; but further experiments are well worth trying, seeing this new substance can be bought at under one shilling a pound, while good shellac costs about three times the price. It is possible that treatment with an alkali may take from the kauri gum that principle which causes the surface gloss of the varnish to be so destructible. We may conclude our notice of this very interesting product by stating that all three of the varnishes give most excellent surfaces for retouching upon with black lead; indeed, we have met with no varnish superior to them for the purpose.—*British Journal of Photography.*

Communications.

Steam Economy Again.

To the Editor of the Scientific American:

Your correspondent, S. W. Robinson, in your issue of June 16, seems not to understand my language, in your issue of May 26, in regard to the loss due the clearance of an engine. In the process of calculation there referred to, and in all other processes in which the diagram is charged with the consumption indicated by its terminal pressure, and credited with the work performed as shown by its mean effective pressure, the loss occasioned by clearance through increased terminal pressure for a given load, or diminished mean effective pressure for a given consumption, is fully recognized, as the factors used in the calculation are the ones affected by clearance. It was the loss which is occasioned by "the expansion of the steam in the clearance space," when the exhaust or terminal pressure is greater than the return or counter pressure, which was referred to as restored when the compression pressure reached that of the exhaust.

I was not attempting to give the conditions necessary "for securing the highest percentage of useful effect from the steam used," but merely discussing a method of calculating the theoretical rate of water consumption indicated by any actual diagram, whether favorably or unfavorably conditioned. Hence there is no conflict between my statements and those of Rankine, either as given in his work or as ably illustrated by your correspondent; we are simply not talking about the same thing, as I am sure he will see if he gives my article a careful re-perusal.

Salem, Ohio. J. W. THOMPSON.

Casting of a Large Gun.

The heaviest gun ever cast in this country, with perhaps two exceptions, was successfully produced at the South Boston Iron Company's works, near the Broadway bridge, South Boston, May 30, in the presence of about 150 persons, several of whom were ladies. Colonel Crispin, Colonel Bayler, Captain Phipps, Captain Bryant, Lieutenant Smith, and Lieutenant Whipple, of the Ordnance Corps: Colonel Randall, Major Sanger, Captain White, Captain Andrews, Lieutenant Nichols, and Lieutenant Patterson of the First Artillery, were present. The material used was the ordinary charcoal iron. The gun, which will be a 12-inch rifled Rodman, carrying a 700 pound conical ball, when finished is expected to measure 263 inches, or about 22 feet in length. The diameter at the widest part will be 55 inches, and the casing will be 20 inches for a depth of 232 inches. At the muzzle the outside diameter will be about 29 inches. The weight when finished will be 89,530 lbs., and when cast was about 162,000 lbs. There was 90 tons of metal in the three furnaces. The gun is expected to be completed in November. It is estimated that the mass will cool in about 150 hours.

Three large furnaces were used for the melting. The flask, which was some 29 feet long, was sunk all but about six feet into the ground, muzzle up. From the furnaces were runners, a sort of iron trough or spout, lined with clay, about 8 inches wide at the top, 4 inches at the bottom, and 6 inches deep, and each about 18 or 20 feet long. These led to a sort of central tank or pool within 6 or 8 feet of the point where the flask or mould was placed. In this was an opening which led into two runners like those coming from the furnaces, and the runners carried the material from the pool to the mould. The pool was for the purpose of equalizing the consistency of the iron before it entered into the composition of the gun. At about 4:50 the visitors were requested to preserve quiet; the word was given, and the deep red stream of molten iron was soon seen rolling through the runners, with the accompaniment of great quantities of beautiful golden stars scintillating over the fiery mass. From the pool the liquid, after being thoroughly amalgamated, passed through the shorter runners and dropped to the bottom of the mould, the material rising gradually until the level of the troughs was reached. This occupied about 15 minutes, and then it became necessary to pour in from the top, which was several feet above the troughs. This was done by filling ladles (great tubs of iron lined with clay), each holding several tons of melted iron, and swinging them by three enormous derricks around to a runner raised higher than the others, and which led to the top of the mould. The portion filled up with ladles was in addition to the length of the gun, which must be cut off some six feet. This is necessary in order to have the end perfectly solid. The gun was cast upon the Rodman principle of having the core, which is hollow, filled with water during the process of casting by means of a pipe to convey cold water to the bottom of the core, and another to carry off the water from the top when it becomes heated. This causes the cooling inside and outside to be much more uniform, and adds greatly to the strength of the gun. The casting was finally finished about 5:30 o'clock, without accident of any kind. The gun when finished will be forwarded to Sandy Hook for experiments by the United States authorities.—*Boston Journal.*

Strength of Metals.

Some experiments have recently been made, in the mechanical technical laboratory of the Royal Polytechnical School at Munich, upon the strength of different alloys made by L. A. Riedinger at Augsburg. The results may be tabulated as follows:

Alloy	Strength in lbs. per square inch.	Contraction of section, per cent.	Stretching of 1½ inch, per cent.	Appearance of the fracture.
Phosphorus bronze..	27,122	2·4	2·25	Fracture blue-gray, darker than in bell-metal; contained an air-bubble of $\frac{1}{10}$ inch in diameter.
Ditto	28,400	3·7	2·50	Fracture as before, with many little bubbles.
Bell metal.....	24,424	1·4	1·50	Fracture uniform, bluish gray.
Ditto	23,288	0	1·00	Fracture rougher than before; color somewhat lighter.
Common brass.....	20,448	14·2	4·50	Fracture dirty, yellow, dense, and quite fine.
Ditto	11,158	13·5	5·25	Fracture as before.
Fine brass.....	22,720	35·2	23·75	Fracture golden yellow, uniform, somewhat rougher than the other.
Ditto	20,306	34·5	15·25	Fracture as before, with orange yellow spots.
Common zinc	1,931	0	0	Fracture alternately bright and dull, coarsely crystalline.
Ditto	2,144	0	0	Fracture lighter, bright, and more uniform than before.
Belgian zinc.....	4,288	0	0	Fracture brilliant white, with fewer large crystals than before.
Ditto	3,209	0	0	Fracture as before; crystals rather larger.

Unfortunately the composition of the alloys tested is not accurately given in percentage. Nevertheless, the table is of interest as showing the superior strength of phosphorus bronze. It is quite surprising that, with the number of excellent testing machines in use in this city and country, so few results have been published here, our figures being mostly limited to iron and steel.

Turkey in America.

The largest single contract ever taken in this country from a foreign nation is the $17,000,000 one given to the Providence Tool Company by the Turkish Government. The Tool Company were three years in preparing to begin the work upon the contract, and now employ 2,500 men, who turn out 200,000 guns per year, or 600 finished guns in a day. These guns are the Martini-Henry rifles. One of the side businesses of magnitude which has grown principally out of this contract is that of the Excelsior Box Company of Providence, of which James A. L. Amoreux of this city and South Hadley Falls is treasurer. The Excelsior Box Company are now busy making 20,000 boxes per year for the Tool Company in which to ship their guns to Turkey. Each box is made to hold twenty of the guns, and with such accuracy are the groove pieces for the interior of the boxes made that they do not allow a play of even one two-hundredth part of an inch of the arms, when packed with the muzzle tip and shoulder piece resting in the grooves. No other precaution is needed or used in packing the guns for shipment to Turkey. The machinery for the manufacture of these boxes was perfected in invention for the purpose. The company have still two years in which to complete the number of these boxes that they contracted to make; by which time, also, the Tool Company will have completed their immense contract with the Turkish Government.—*Springfield Union.*

A Remarkable Map.

About the first of January, 1876, Professor Hitchcock, of the Geological Survey, and his assistants began the construction of a raised map of New Hampshire, the design of which was to combine all the present knowledge of the geography of the State which had been obtained in the geological survey made by Professor Hitchcock, Professor Huntington, and others. This map has just been completed, and placed in the State House.

The map is fourteen feet ten inches long, representing one hundred and seventy-eight miles in length (being constructed on a scale of one mile to the inch) and ninety-three miles in width, from the mouth of the Piscataqua river to the northwest corner of Hinsdale, showing the entire surface of the State, nine thousand three hundred and thirty-six square miles. It also shows all the rivers and brooks, ponds and lakes, hills and mountains, and the town and county lines, railroads, etc. The names of all cities and towns, rivers, and principal brooks, lakes and ponds, mountains and high elevations, are given conspicuously, so that any one can find at a glance what they desire to look up. The height of the hills and mountains is given on a scale of one inch to one thousand feet, and actual measurements are given when known.

The map is constructed of pine and bass wood, and the process of the work was this: A map was first drawn on paper of the same size as the raised map, with all the outlines of towns, streams, ponds, etc., and contour lines for each five hundred feet were drawn. Tracings of the contour lines were made on inch layers of pine and bass boards, maintaining as accurately as possible the relative size and shape. These are fastened upon each other, and the valleys are beveled out with chisels.—*Concord (N. H.) Monitor.*

Torpedo Balloons.

A correspondent suggests that torpedo balloons might prove a formidable means of offence, and proposes a plan of sending up a balloon, with a torpedo attached, to windward of an enemy, and then dropping the torpedo by bursting the balloon. It seems to us that this is a good idea, and one which might find useful application in the bombardment of cities, camps, and fortified places. It is of course not practicable against an enemy capable of moving about quickly. It is not a difficult matter to construct a balloon capable of lifting sufficient nitroglycerin for the purpose. This might be inclosed in a shell and suspended as a car under the air ship. A simple mechanical device could easily be provided for dropping the load; and this device might be controlled by a light wire through which an electric current could be sent. The besiegers have only to wait for a fair wind, and then start their balloon from a point far beyond the range of the most powerful guns. It would be easy by the aid of instruments to tell just when the balloon had arrived over the desired point, and the pressure of the key would transmit the current and drop the mass of explosive. The effect of a quantity of nitroglycerin blowing up in a city or fort would be terrific. The balloon could be permitted to rise to a height beyond the reach of artillery, so that the besieged would be totally destitute of any means of directly preventing the dropping of the unwelcome visitor in their midst.

Some well meaning philanthropists in England are just now protesting against the use of the torpedo in modern warfare, as being too cruel a resort, and one which should be classed with poisoned wells and explosive bullets, which are proscribed among civilized belligerents. Probably the torpedo balloon will to them seem exceptionally barbarous. The fact is, however, that such philanthropy is a mistaken sentiment. War itself is a frightful calamity; and it is for the benefit of all that it should be as quickly ended as possible. This result can only be reached by making weapons so effective either that people will not face them, and thus fighting may be stopped in that way, or else that they will produce such wholesale destruction as to secure victory for one side or the other in the quickest possible period. The most destructive weapons are therefore the most merciful; and in this light the torpedo should be regarded.

Russian Gold and Silver Production.

The following statistics of the yield of the Russian gold fields for the year 1876 show that this source of wealth is considerable in that cold northern clime. The amount of gold mined in 1876 was 1,617 pouds, equal to 71,503 lbs. troy, having a value of 22,086,632 roubles = $17,669,329.60. The silver amounted to only 156 pouds, or 5,616 lbs. avoirdupois, worth 142,360 roubles = $113,888.

NICHOL'S RAILROAD JOINT AND NUT LOCK.—In our recent illustrated article on this subject, the statement that the joint would be safe without any bolts "on the same section of rail" should read "on some sections of rail." Also for "requires no spikes in the flange of the rail," read "slots or notches" for "spikes."

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A NEW LECTURE EXPERIMENT.

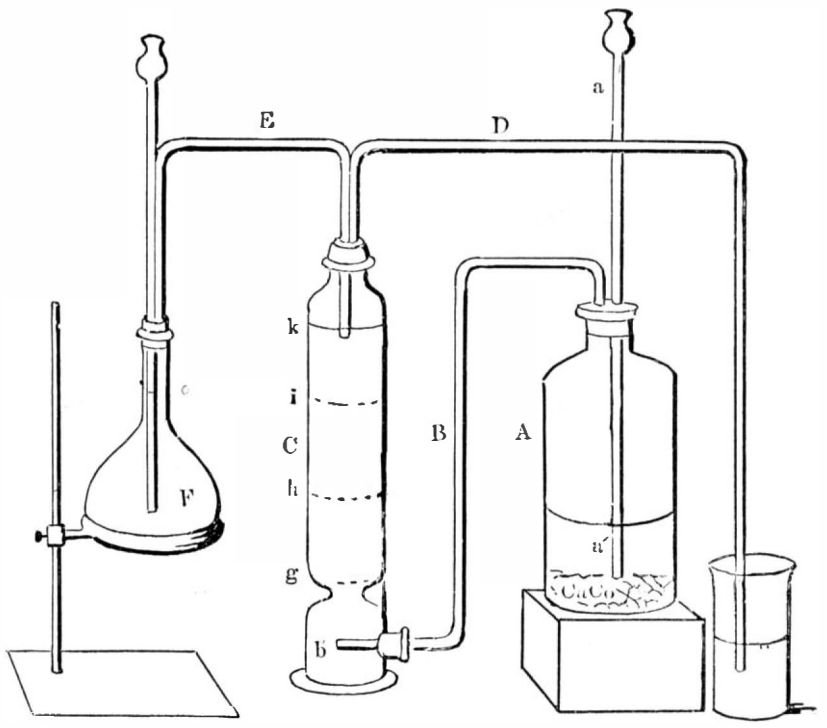
BY E. J. HALLOCK.

To illustrate the principle employed in the manufacture of soda ash by Solvay's ammonia soda process (see SCIENTIFIC AMERICAN of June 24, 1876), as also the method employed in carrying it into practice, the author employs the following simple apparatus, consisting of a wide mouth bottle, a flask, and a chloride of calcium drying tower, such as may be had of all dealers in chemical glassware, and which are to be found in most laboratories. The chloride of calcium tower, C, is nearly filled with a clear saturated solution of common salt. At *g* is placed a disk of wire gauze, and other disks may be placed at *h* and *i*, if convenient. In the bottle, A, is generated carbonic acid gas which passes down through B, and enters the tower, C, at *b*. In the flask F, ammoniacal gas is evolved, either by boiling strong *aqua ammoniæ*, or by heating together slaked lime and sal ammoniac. This gas enters the tower, C, through a tube, E, which dips but an inch or two beneath the surface of the liquid, *k*. The tube, D, may lead into a second tower similar to C, or merely dip into a beaker of water. The funnel tube, *a*, should be somewhat longer than the height of the tower, C, so that the pressure of the column of liquid, *a a'*, shall be equal to that of a column of brine equal to *bk*. It was found by experiment that in order to overcome a pressure of 12½ inches in C, and 1½ in D, the column, *a a'*, was 16 inches or more. The flask, F, should also have a long safety tube. In a few minutes after the gases begin to be evolved, the liquid in C becomes milky from the formation of bicarbonate of soda, which is kept in suspension by the motion of the gas. In half an hour the operation is interrupted, when the bicarbonate of soda will soon settle on the bottom of the tower and on the disks of wire gauze, although the liquid remains turbid for some time. The chemical reaction is as follows:

$$NH_3 + H_2O + Na\,Cl + CO_2 = NH_4\,Cl + Na\,HCO_3.$$

The chloride of ammonia remains in solution and may be drawn off at *b* without disturbing the bicarbonate of soda. The conversion of the bicarbonate into the carbonate of soda by heat is too simple to need illustration.

Columbia College Laboratory, New York city.



THE AMMONIA SODA PROCESS.

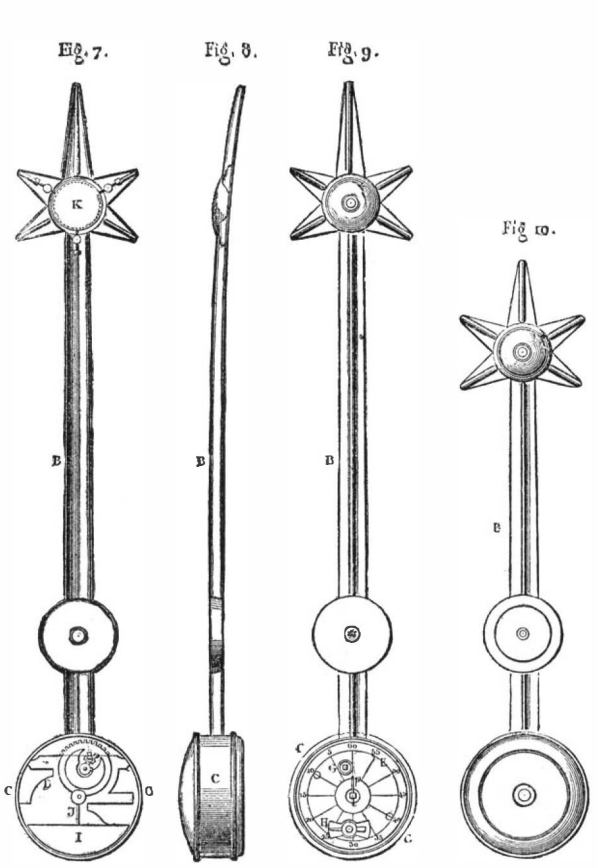
THE SECRETS OF THE MYSTERIOUS CLOCKS.

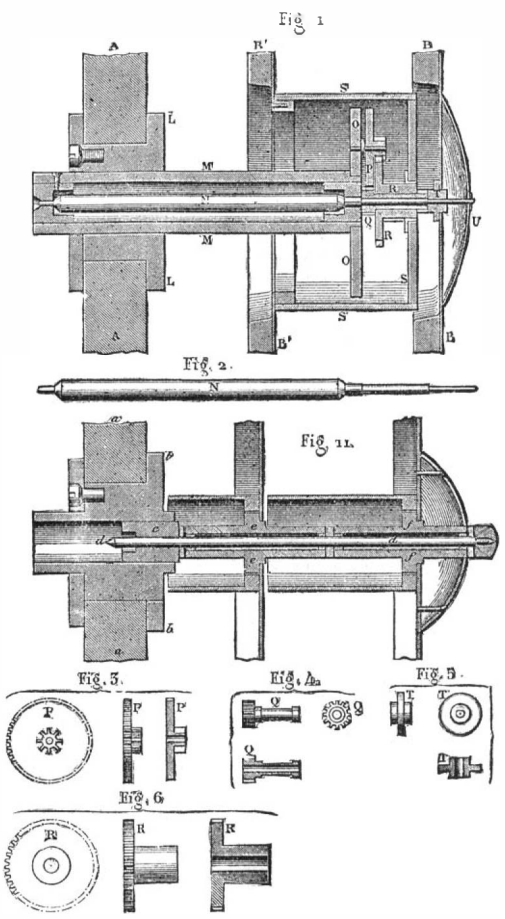
We have frequently placed before our readers descriptions of wonderful clocks, consisting usually of a mere plate of glass on which two hands, apparently destitute of any mechanism, mark the hours, and which return to their proper position, even if moved therefrom. No detailed account of the mechanical construction of these curious devices has appeared until recently, when a committee of the French Society for the Encouragement of National Industry undertook an investigation, the result of which is an excellent illustrated report which we find in the "Bulletin" of that association.

The inventor of the principal forms of mysterious clock now extant is M. Henri Robert, a French chronometer maker. The principle on which the machinery is based is not wholly new, as some half a century ago single-hand clocks, marking hours only, were made on the same plan. The single hand was mounted on a horizontal pivot, and carried, at the extremity opposite to the indicating point, an enlargement like a watch case, which seemed placed there simply for purposes of ornamentation. In this case, however, was concealed a watch train, which once in twelve hours caused the revolution of a little platinum weight around the inner periphery of the box. If we refer this weight and the remainder of the hand to their respective centers of gravity, the center of gravity of the entire arrangement will be found by dividing the distance which separates the two points according to the inverse ratio of the two masses. With relation to the center of gravity of the hand alone, the center of gravity of the combined hand and box will then describe a curve similar to that traversed by the platinum weight, which is a circle. But the system obviously cannot remain in equilibrium in any position unless the center of gravity be directly over the pivot. Therefore, as the center of gravity describes a circle, the hand must likewise move in a circular path in the opposite direction to that of the weight in the box; and as the weight accomplishes its rotation in just twelve hours, the hand will do likewise. It will further be seen that, as the moving of the hand from its proper place does not affect the operation of the clockwork in the box, the hand will always return to the only position in which it can be in equilibrium with the weight.

M. Robert has devised two clocks. In one, the hands communicate. One hand is operated as above described, but its weight travels twelve times faster, so that the hand completes its circuit in one hour, and therefore marks minutes. By a simple concealed train it is connected with an hour hand and transmits motion to it. If the minute hand be whirled around by the finger, on being released it will of course return to its proper place. The hour hand, however, will not, unless the number of rotations imparted to the minute hand happens to be a multiple of twelve.

In his second invention M. Robert uses independent hands. Instead of there being a train uniting them, each hand has its own motive apparatus. One accomplishes its rotation in 12 hours, the other in 1 hour. Hence, either or both hands may be disturbed, and both will return to mark the exact time.





ROBERT'S MYSTERIOUS CLOCKS.

Figs. 1 to 10 in the annexed illustrations relate to the clock of the first-mentioned type. Fig. 1 is a partial vertical section, passing through the axis of the hands. Figs. 2, 3, 4, 5, and 6 represent details. Fig. 7 shows the rear face of the minute hand, the under cover of the movement case being taken off. Fig. 8 is a profile view of the same hand, the case being closed. Fig. 9 shows the front face also of the same hand, the box cover off; and Fig. 10 is an elevation of the same. A is a circular dial composed of a simple plate of glass on which the hours are marked. B is the minute hand. C is the movement box, and D the watch train within. E is a small dial divided into intervals of 5 minutes each (Fig. 9). F is a pin and also a hand which moves on the dial, E. The winding stem is shown at G, and at H is the usual watch-regulating device. I (Fig. 7) is the platinum weight, of flat segmental form. This is supported by the arm, J, Fig. 7, which is fixed on one of the ends of the axis which carries at its other end the pin, F, Fig. 9. In order to regulate the movement, it is necessary to place the hand, F, on the same minute mark on E as the hand, B, indicates on the dial, A. At the opposite end from that to which the case is affixed, the minute hand, B, terminates in a star, below the center of which is a counterweight, K (Fig. 7), held by three adjusting screws. By the latter the weight, K, may be so moved as to balance the hand accurately.

The hour hand, B', Figs. 1 and 10, is of the same shape as the minute hand: but its case, placed on the end simply for symmetry, contains no movement. The operation of this hand is governed by the following mechanism: L is a plate fixed on the front face of the dial, A, Fig. 1. It is held in place by another plate, with screws disposed on the other side. M is a tube passing through plate, L, and inclosing the axis, N, of the minute hand. This axis is concentric with the tube, M, and the conical ends of its enlarged central portion bind on corks in said tube. Fig. 2 shows this axis separately. Riveted on the front portion of tube, M, is a disk, O. P is a minute wheel, carrying at the center a pinion, and mounted loose on an axis fixed to the disk, O (see detail in Fig. 3). Q is a pinion, with a sleeve adjusted for friction on the outer enlargement of the axis, N, and engaging with the wheel, P, Figs. 1 and 4. R is an hour wheel mounted on the sleeve of pinion, Q (Figs. 1 and 6), and engaging with the pinion of the minute wheel, P. S is a light case attached to the sleeve of wheel, R. It covers disk, O, and all the train, and is attached by a screw to the hour hand, B', Fig. 1. T is a barrel mounted for friction on the prolonged end of axis, N, and turning therewith. To this barrel the minute hand, B, is secured. At U is a fastening disk and pin. The minute hand, B, is moved by the travel of the weight in the case attached to its extremity. In turn, it causes motion of the axis, N, which (through the pinion, Q, of the wheel, P, the pinion of the wheel, R, and the box, S) operates the hour hand, B'.

Fig. 11 is a vertical section of the mechanism of the clock with independent hands; *a* is a dial analogous to that in Fig. 1; *b* is a plate disposed similarly to plate, L, already described; *c* is a cork mounted for gentle friction in the central tube of plate, *b*; *d* is the axis of the hands; *e* is a tube carrying the hour hand and turning freely on axis, *d*; *f* is the barrel which carries the minute hand. A small steel disk is placed between barrels, *e* and *f*, to each of which the hands are connected by sleeves. The hands are balanced by counterweights to their ends, as previously described.

The Iron Industry in Greece.

The Athens correspondent of the *Deutsche Industrie Zeitung* writes that the manufacture of iron, which was begun a few years ago by a metallurgical association in Athens, has been abandoned because of the scarcity of stone coal, although brown coal is abundant in Greece. The writer suggests that German iron makers could purchase iron ore in the island of Seriphos at very low prices. These ores are brown hematite, red hematite, and specular ore, which can and will yield 25 to 30 per cent of metallic iron. These beautiful ores can be bought for 10 francs ($2) per ton. One deposit of these ores is calculated at 500,000 tons, and the island thus rich in iron ore has been named "Sidera Nesos," or Iron Island.

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FROST'S VARIETY SELF-CENTERING CHUCK.

We can commend the new chuck represented in the annexed engraving as one of the best that we have ever seen. It embodies a mechanical construction which enables the implement to hold tools of any form of shank; it is perfectly self-adjusting, its wearing surfaces are exceedingly large; it has no gearing or multiplicity of parts; and the way in which the four simple proportions are made to answer all the various requirements strikes us as a remarkable exhibition of inventive ingenuity.

The chuck consists, first, of the outer casing or collar, Fig. 1. In this there is an aperture which receives the screw,

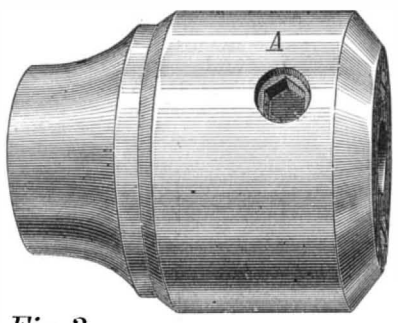
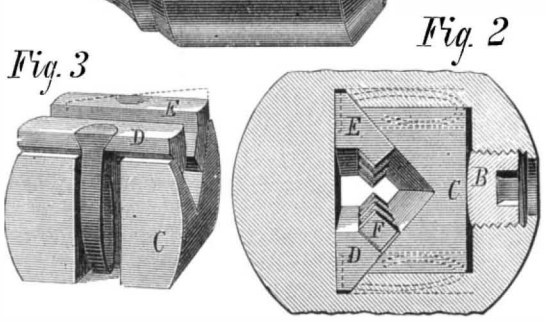


Fig. 1

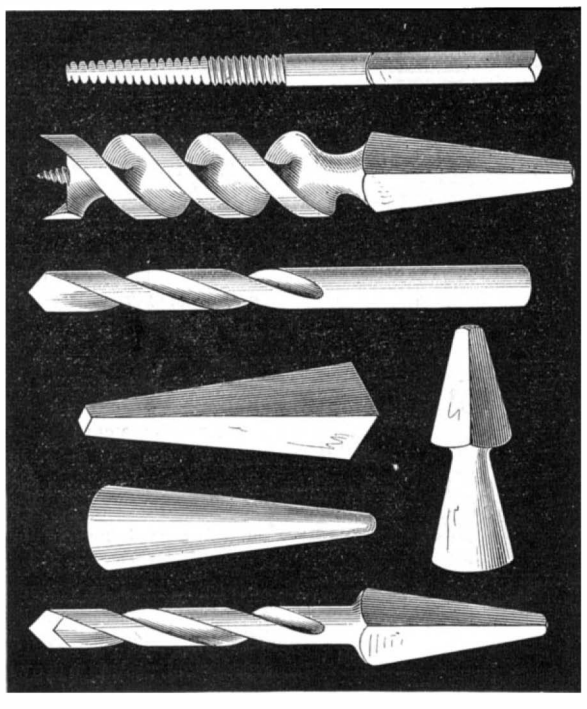


B, Fig. 2. Said screw has a square recess in its head, and is turned by an ordinary key. The lower end of the screw bears on the jaw, C, Fig. 3. The under face of this jaw is V-shaped. In each of its sides is a recess to accommodate the bent springs, which are attached to the jaws, D and E. These jaws bear flat against against the case, and, by their inclined sides, bear also against the V of jaw, C. They are provided with projections at F.

From Fig. 2 it will be evident that, if the jaw, C, is pressed down, its inclined faces, acting on the upper inclined sides of jaws, D and E, will force said jaws together, and as contact becomes closer, the projections, F, on the latter will interlock. The square-shanked tool will then be held on two sides in the V of the jaw, C, and on the other sides by the proximate parts of jaws, D and E; and the tool will be the more tightly held as the screw, B, is turned down. When the screw is relaxed and the tool removed, the springs on jaws, D and E, will expand, and the jaws will thus be carried back to their former places. It will be observed that these springs have no actual duty to perform. There is no strain upon them, and their only office is to draw the two light pans back again into place.

Now if a tapered tool be inserted, in order to fit its shank, the two moving jaws, D and E, must assume an angular position. This they can easily do, because their springs are single and attached to them directly at the middle of their length, so that they can pivot on the springs. Also the upper jaw rolls on the screw end; and there is abundant space between its top and the casing to allow of considerable angular movement. Its front sides, as shown in Fig. 3, are curved,

Fig. 4.



so that this radial or balancing movement does not alter the length of the aperture which it aids in forming. The device is one of those which, although comprehensible at a glance, is difficult to explain; but the shape of the tapered orifice formed will, we think, readily be understood from Fig. 2. As the jaws adjust themselves, being perfectly free to adapt their movement to any shaped object placed between them, it is no longer material that tools be provided with a uniform shank. In Fig. 4, we have represented a variety of forms covering those in common use. These we have tested in the chuck, and it holds them all with equal facility, accurately, and in true center.

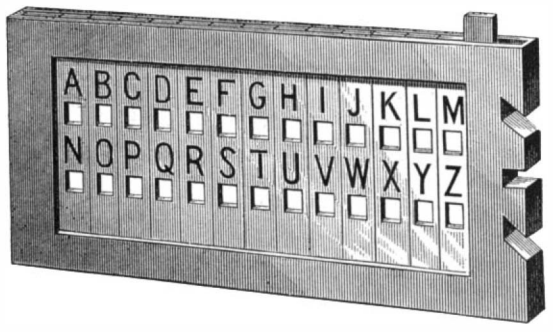
For further particulars address the inventor, Mr. William Frost, 53 Dartmouth street, New Bedford, Mass.

Application of Electricity in Dyeing.

According to the *Bulletin de la Société Industrielle de Mulhouse*, Goppelsroeder has observed that if an electric current is passed through aniline dye becks decoloration ensues, with formation of colorless salts of lenkaniline. If yarns or cloths are steeped in the liquid they absorb it, and on subsequent exposure to the air they become colored, just like the goods drawn out of an indigo vat and exposed to the air. The colors thus obtained are said to be faster than those produced by the ordinary method. Whether this principle of dyeing will prove practically useful remains to be seen.

A NEW METHOD OF SECRET WRITING.

The annexed engraving represents a simple device for purposes of secret writing, by means of which may be prepared communications intelligible only to persons having a similar apparatus, and impossible to be deciphered by any one else. The device is simply a sheet of metal upon which the alphabet is written in two parallel rows, and beneath each letter an opening is made. The plate is inclosed in a suitable frame. It will be seen at once that, if this apparatus is laid over paper, and dots made on the latter through the apertures—under A, B, C, for example—the marks when the paper is removed will have no signification. If, however, the recipient of the communication should place over the paper an apparatus of precisely similar construction, then the dots would of course show through the apertures under A, B, C; and he would know that those letters formed the message. It will readily be seen how words can be indicated in this way. In cases where letters are placed in inverse order, a small inclined line is drawn through one of the side slots in the frame. This indicates the mode in which the letters should be read. Double letters are indicated by vertical lines in place of a simple dot, and words are separated by a horizontal dash. The invention seems excellently



adapted to the purpose, and might preferably be used in lieu of cipher codes.

Patented December 26, 1876. For further particulars, address the inventor, Rev. Alexander Berghold, New Ulm, Brown county, Minn.

Captain Burton's Discoveries in the Land of Midian.

A correspondent of the London *Times*, writing from Alexandria, informs the public that Captain Burton, the African traveler, has made a "find" of unusual interest. At the request of the Khedive he has visited the land of Midian, the desolate region on the eastern side of the Gulf of Akabah, the easternmost of the two long and narrow estuaries in which the Red Sea ends.

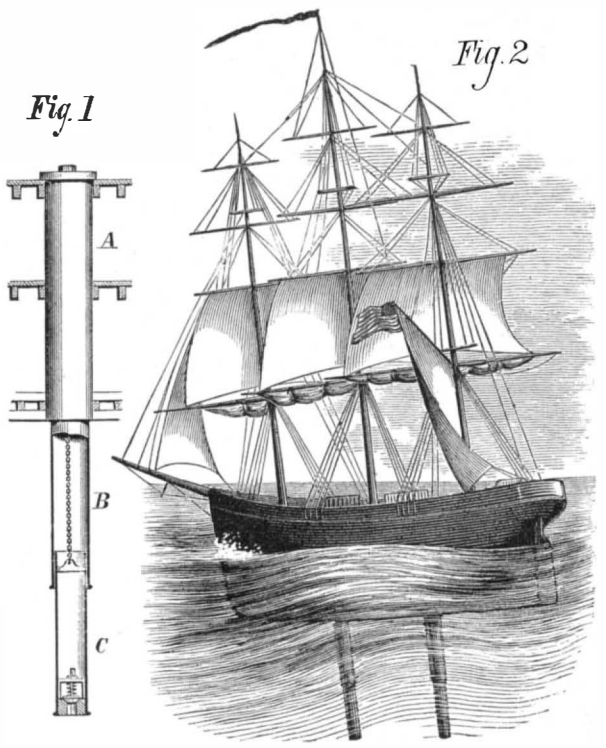
Accompanied by M. George Marie, a French engineer, Captain Burton landed in Midian on 2d April, and in an exploration of some weeks explored a region full of ruined towns, built of solid masonry, with made roads, aqueducts five miles long, artificial lakes and massive fortresses, all marking a wealthy and powerful people. Their wealth was based on mining operations, and Captain Burton reports the existence of gold, silver, tin, antimony, and turquoise mines. The auriferous region is extensive; indeed, the discoverer believes he has opened up a California, and the Khedive proposes to have the country worked by European capitalists.

It will be remembered that in the Bible, Midian is always described as a land full of metals, especially gold, silver, and lead. It is more than probable that Solomon's Ophir was situated there, as the small ships in which he imported gold, ivory, and peacocks were launched at the head of the Red Sea. Midian is part of the Egyptian Viceroyalty.—*London Spectator.*

IMPROVED BALLASTING TUBE FOR VESSELS.

The invention illustrated herewith consists in providing vessels with a series of pipes extending from their bottoms to the depth of about thirty feet. The pipes are telescopically constructed, so that they may be easily lowered below or raised up within the hull of the vessel. The inventor claims that this device, as it enables the ship's center of gravity to be lowered, will prevent vessels rolling or capsizing, check their leeway, and obviate the use of ballast or drags.

The construction of the tubing is shown in Fig. 1. Fig. 2 exhibits its application to the vessel. A large pipe, A, extends upward from the keel to the spar deck and serves as a well. Through a suitably packed collar in the lower portion passes a second tube, B; and through the latter, a third tube, C, in the bottom of which is a valve, held down by a spring which yields and allows the valve to open when the tubes descend, so that they may become filled with water. A chain, attached as shown to tubes, C, serves to raise and



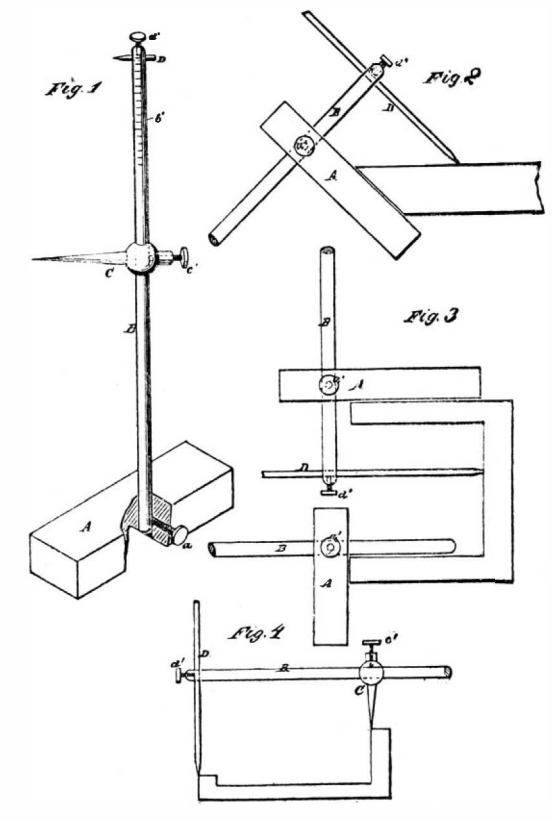
lower the device as desired. The tubes may be arranged to pass directly through the keel, or they may be disposed on each side of the same.

Patented April 10, 1877. For further particulars, address the inventor, Rev. Alexander Berghold, New Ulm, Brown county, Minn.

IMPROVED GAUGE.

Mr. Benjamin F. Stoner, of Rockford, Ill., has patented through the Scientific American Patent Agency, May 1, 1877, an improved instrument, which may be used as a gauge for all irregular surfaces and for work which an ordinary gauge cannot reach. It may also be used as a marking gauge, as a try square, and as a trammel.

A represents the head, which is rectangular in form, and may be plated with metal to prevent wear, and which receives the rod, B. The latter is secured in place adjustably by a set screw, *a'*. C is the pivot finger of the trammel, which is made with a globe socket upon its base to receive the rod, B, and is secured adjustably upon said rod by a set screw, *c'*. D is the marking needle, which is passed through a hole in the rod, B, near its outer end, and is secured in place adjustably by a set screw, *d'*, passing in through the end of the said rod, B. The needle, D, may be made short, as shown in Fig. 1, for convenience in using the instrument as an ordinary



marking gauge, or long, as shown in Figs. 2, 3, and 4, to adapt it for use for gauging irregular surfaces, and for use as a trammel. Upon the rod, B, is formed a scale, *e*, of division marks. When the instrument is to be used as a square, the rod, B, can be adjusted to any desired length, and can be used where the blade of an ordinary square would render it inconvenient to use it, or prevent its use.

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AN INTERESTING MARMOSET.

We select, from the pages of the *Illustrated Sporting and Dramatic News*, the accompanying engraving of a recent arrival at the world-renowned Zoological Gardens, situated in the Regent's Park. The look of intelligence and docility on his countenance much resembles that seen on the face of a King Charles' spaniel; but his feet and claws are evidently made for mischief, and he is not therefore suited for a domestic pet, although his dimensions (the engraving is of the size of life) adapt him to be carried in the vest pocket or attached as a pendant to a watch chain.

The marmoset is a South American monkey, much resembling a squirrel in form and agility; and the *marikiva*, or silky marmoset, is of a golden yellow color, its fur being very soft and of the color of raw silk, deepening in shade on the paws. It is, in its natural state, very clean in its habits; and if not properly attended to when in captivity, it pines away and dies. Its usual voice is gentle, but it hisses loudly when irritated. The *leoncito*, or leonine marmoset, is endowed with a mane of considerable proportions, which it erects when angry. It is the smallest known animal of the monkey tribe.

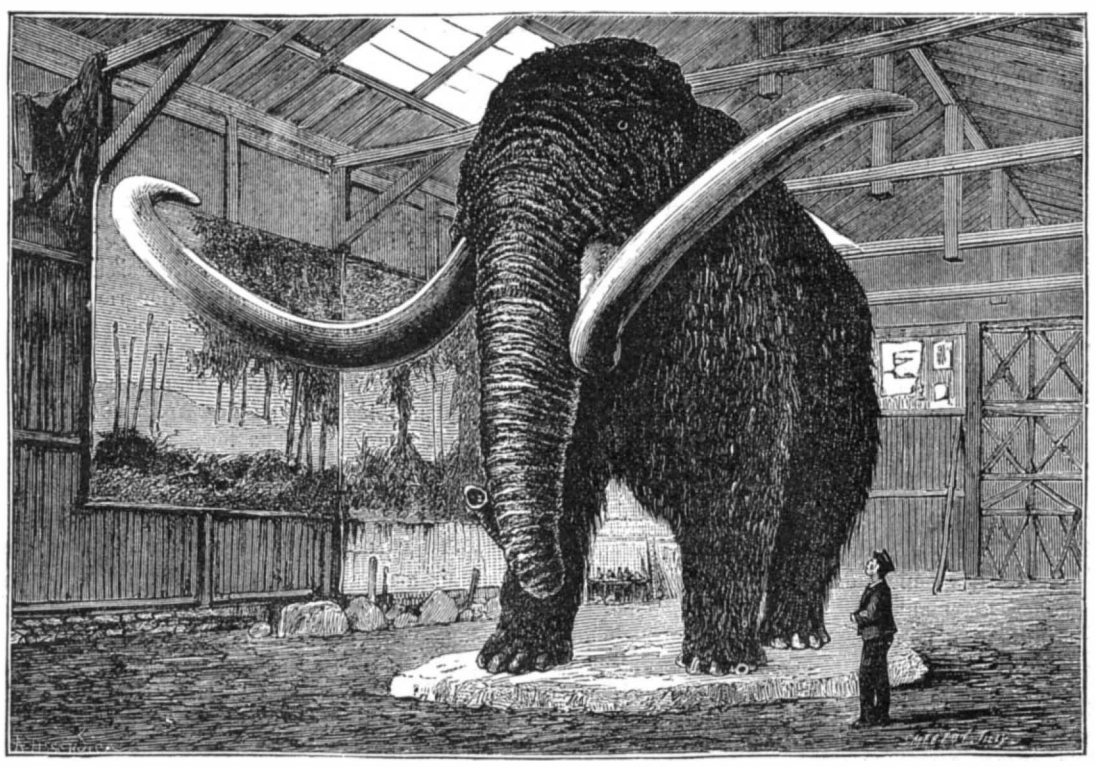
Preservation of Aqueous Tartaric Acid Solutions.

One of the chief objections to the use of tartaric acid as a reagent or in alkalimetry is the readiness with which its aqueous solutions decompose. The detection of potash in solution is difficult, owing to the solubility of all its neutral and most of its other salts. The acid tartrate of potash is soluble in 200 parts of cold water, while the double chloride of platinum and potassium dissolves in 140 parts cold water; hence tartaric acid is a more delicate test than chloride of platinum. Professor Wittstein announces the discovery of an easy method of preventing decomposition in the use of salicylic acid. A freshly prepared solution of 1 part tartaric acid in 5 parts water, has added to it about $\frac{1}{1000}$ part salicylic acid. In an unprotected solution of tartaric acid, the well known flocks appear in two weeks; while a relatively small quantity of salicylic acid has kept a solution pure and clear for three months, and may, he expects, preserve it unaltered for a year or more, a question which can only be settled by time. Dr. Wittstein claims also that tartaric acid solutions may be used in alkalimetry, as the amount of acid does not change for a year even when these slimy flocks form in the solution. We see, however, no reason to prefer this acid to the more permanent oxalic acid, when an organic acid is desired for a normal acid solution.

AN ARTIFICIAL MAMMOTH.

M. Martin, a German naturalist, has recently constructed artificially a mammoth (*elephas primigenius*) of the quaternary epoch, after the many fine fossils of that extinct animal now existing in the Natural History Museum of Stuttgardt. The form of the body of the gigantic creature, its trunk, tusks, and hair (the latter a close imitation of that of the real animal found in the Siberian ice) have been wonderfully counterfeited, so that the resemblance is as accurate as if the mammoth's skin had been stuffed. The animal, a representation of which is given in the annexed engraving from *La Nature*, measures 16 feet in height by nearly 26 feet in length. It is made upon a wooden framework, covered with wire cloth, the latter being coated with *papier maché*. The hair is reproduced from the fiber of an Indian palm, the tusks are of wood, and the trunk is ingeniously made of paper.

We are glad to notice that this valuable work has been purchased by Professor H. A. Ward for his Museum of Zoölogy and Comparative Anatomy in Rochester, N. Y. It has already been packed, and is now on its way to this country.



M. MARTIN'S ARTIFICIAL MAMMOTH.

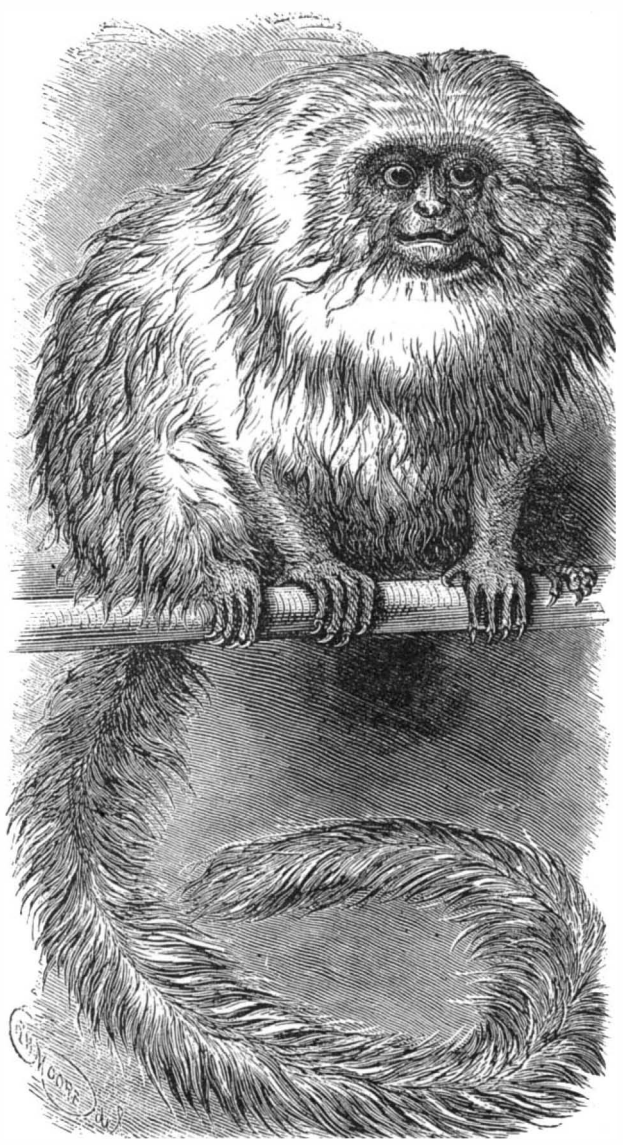
Coating Metals with Platinum.

A Frenchman named Dodé recommends the following process for coating cast iron, whether rough or enameled, with platinum: The metallic articles are first moistened by means of a brush dipped in oil of turpentine, then immersed in a mixture of borate of lead and oxide of copper, and baked in an oven. When thus prepared, they are dipped into a mixture of borate of lead, litharge (or massicot), chloride of platinum, ordinary ether, oil of lavender, and amylic ether, and then heated.

New Method of Manufacture of Steel Armor Plates and Blocks.

The trials of the 100 ton gun at Spezia resulted in some remarkable deductions in favor of steel armor, and it now appears probable that steel plates will supplant iron in the armament of war vessels. Mr. James Yates, of Rotherham, England, has patented, March 13, 1877, a new process of making steel blocks for armor purposes, which is as follows:

Molten steel of one temper or hardness is run into an open or closed mould, and then upon its upper surface a second layer of molten steel of another temper or hardness is added. its operation is repeated so as to form as many strata of a different tempered steel as may be desired, arranged according to their temper or hardness, forming thereby one solid and compact compound mass. This may be either at once ured or be stamped, rolled, or pressed, to give the form required, and to impart strength to bear greater pressure or strain tensibly, compressively, or by impact from projectiles or heavy blows. The molten steel, of varying temper and hardness, is successively poured into the mould before the preceding stratum is cold.



MARMOSET AT THE ZOOLOGICAL GARDENS, LONDON.

A TUNNEL under the Pyrenees, uniting France and Spain, will be opened at the beginning of next year.

The Tern.

Mr. Thomas Edward, the Scotch naturalist whose pursuit of Science amid toil and privation has gained him such just renown, writes as follows concerning the tern. He was, one afternoon in August, watching the evolutions of a flock of these birds, which were engaged in fishing in the Firth of Boyndie. He was seeking an opportunity to bag one of the beautiful creatures, when, as if in answer to his desire, a noble specimen directed its course to the shore, fishing all the way as it came.

"Once more he soars aloft on lively wing, and, having attained a certain elevation, and hovering, kestrel-like, for a little, with quick repeated strokes of his pinions he rapidly descends. Again, however, his hoped-for victim has made his escape; and he bounds away in an oblique direction, describing a beautiful curve as he rises without touching the water. Shortly after he wings his way nearer and nearer to the beach; onward he advances with zigzag flight, when suddenly, as if struck down with an unseen hand, he drops in the water within about thirty yards of the place where I am standing. As he righted and sat on the bosom of the deep, I was enabled distinctly to perceive that he held in his bill a little scaly captive, which he had snatched from its home, which struggled violently to regain its liberty. Its struggles were in vain; a few squeezes from the mandibles of the bird put an end to its existence.

"Being now within my reach, I stood prepared for the moment when he should again rise. This he did as soon as the fish was dispatched. I fired, and he came down with a broken wing, screaming as he fell into the water. The report of the gun, together with his cries, brought together the party he had left, that they might ascertain the cause of the alarm. After surveying their wounded brother round and round, as he was drifting unwittingly toward the shore with the flowing tide, they came flying in a body to the spot where I stood, and rent the air with their screams. These they continued to utter, regardless of their individual safety, until I began to make preparations for receiving the approaching bird. I could already see that it was a beautiful specimen; and I expected in a few moments to have it in my possession, being not very far from the water's edge.

"While matters were in position, I beheld, to my astonishment and surprise, two of the terns take hold of their wounded and disabled comrade, one at wing, lift him out of the water, and bear him out seaward. They were followed by two other birds. After being carried six or seven yards, he was left gently down again, when he was taken up in a similar manner by the two who had been hitherto inactive. In this way they continued to carry him alternately, until they had conveyed him to a rock at a considerable distance, upon which they landed him safely. Having recovered my self-possession, I made towards the rock, wishing to obtain the prize which had been so unceremoniously snatched from my grasp. I was observed, however, by the terns, and, instead of four, I had in a short time a whole swarm about me. On my near approach to the rock, I once more beheld two of them take hold of the wounded bird as they had done already, and bear him out to sea in triumph, far beyond my reach. This, had I been so inclined, I could no doubt have prevented. Under the circumstances, however, my feelings would not permit me; and I willingly allowed them to perform without molestation an act of mercy, and to exhibit an instance of affection which man himself need not be ashamed to imitate. I was, indeed, rejoiced at the disappointment which they had occasioned, for they had thereby rendered me the witness of a scene which I could scarcely have believed, and which no length of time will efface from my recollection."

Do Snakes Catch Fish?

Mr. J. Y. Detwiler, of Toledo, Ohio, states that, on May 20 last, he killed a water snake in a small brook, which, when opened, was found to contain a fish, about 6 inches long, partly digested. He also has caught water snakes on trout lines baited with minnows; and he once caused a water snake to disgorge a fish about 8 inches long.

Yield of Wine in France.

The wine crop of France in 1876 was only 41,846,748 hectoliters (a hectoliter = 22 gallons), as compared with a yield of 83,836,391 hectoliters, or more than twice the quantity in 1875. The disease of the vines has caused this unfavorable result.

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Science in War.

The present Russo-Turkish war cannot well be less interesting than those that have so recently preceded it, and we may especially point out two directions in which fresh examples of scientific warfare will probably manifest themselves—in connection, namely, with the cavalry pioneer and the Whitehead torpedo. Both of these will probably be seen in warfare for the first time, and before many days are past we may hear of their doings in action. The cavalry pioneer must not be confounded with the Prussian uhlan, who played so conspicuous a part in the last war. The ubiquitous uhlan, terrible as he was, did not work the injury which some of the Cossacks will have it in their power to inflict if accoutred as pioneers. These are selected from the smartest and most daring troopers, lightly armed and well mounted. In a belt round their waists they carry a few pounds of guncotton or dynamite, and with this highly destructive explosive they may work incalculable harm. A small charge of guncotton placed simply upon a rail and fired with a fuse suffices to blow several feet of the iron to a distance of many yards, thus rendering the railway unservicable on the instant. A trooper may dismount, place a charge at the base of a telegraph pole, fire it, and be in his saddle again within 60 seconds. Wires may thus be cut and communication stopped in the heart of an enemy's country by fearless riders, who have but to draw rein for an instant to effect the mischief, while lines of railway in the neighborhood are entirely at their mercy. Even light bridges and well built stockades may be thrown down by the violent detonation of compressed guncotton, and forest roads considerably obstructed by trees thrown across, which are never so rapidly felled as when a small charge of this explosive is fired at their roots. The influence of the Whitehead torpedo, of which we have heard so much of late, will likewise be felt for the first time during the present war. An implement so ingenious in its character that, as Lord Charles Beresford the other day happily remarked, it can do almost anything but talk, is in the possession of both belligerents, and will doubtless be heard of before long on the Danube and in the Black Sea. These torpedoes are manufactured at Fiume on the Mediterranean, and, like Krupp guns, are to be purchased by any one who chooses to pay for them.

The Sutro Tunnel.

Considerable interest is now being taken in the progress of the Sutro tunnel, as it is advancing quite rapidly towards the Comstock, and is only 2,800 feet east of the workings of the Savage mine. At the date of the last measurement the total length of the tunnel was 16,913 feet. The *Enterprise* is authority for the statement that the tunnel has, during its progress thus far, cut twelve separate and distinct ledges, yielding assays of from $2 to $20. One of them was 112 feet in width; yet not a foot of prospecting has been done in either side of the tunnel. These statements are of interest as showing the immense lateral extent of the Comstock deposits. Other ledges may yet be struck by the tunnel in its course, any or all of which may be worked on the completion of the tunnel when they have time to turn their attention to mining.

At present, of course, the whole energies of the company are directed to putting the header along as fast as possible, so as to get at the Comstock. There is not so much opposition to the project as formerly among the mine owners and property owners of Virginia and Gold Hill, and it is conceded that the tunnel will save great expense in draining the mines. Still they object to the two dollars per ton royalty on ores; but if it is proved that the tunnel will drain and ventilate the mines, they can afford easily to pay that sum without grumbling. The projectors of the enterprise have shown indomitable pluck and energy in carrying out the plan amid so many difficulties; and even if the tunnel is not constructed as it should be, as some aver, there will be plenty of opportunity to enlarge, strengthen, and improve it, when the Comstock is reached and funds are more plentiful.—*Mining and Scientific Press.*

Nickel Plating.

Some time ago Herr Stolba published a method of plating iron and steel with nickel by the simple immersion process, and the following plan has been recently put forward by him as an improvement: To a dilute solution (5 to 10 per cent) of as pure chloride of zinc as possible, there is added enough sulphate of nickel to color it strongly green. This is heated to ebullition in a porcelain vessel. The objects, being completely cleaned of grease, are then suspended in the liquid so that they touch each other as little as may be; and the boiling is kept up for from half an hour to an hour, water being from time to time added in place of that evaporated. The nickel is precipitated in a brilliant white layer wherever the surface of the object is not greasy or rusty. The operation can be continued for several hours if desired; but the plating will not thus be rendered much thicker. After removing the objects, they are washed with water holding chalk in suspension, and carefully dried. They may afterwards be cleaned with chalk, and they take a fine yellowish-toned polish. The chloride of zinc used should contain no metal precipitable by iron. When it cannot be obtained of sufficient purity, it may be made by dissolving zinc scraps in hydrochloric acid, and allowing the solution, containing an excess of metallic zinc, to rest, in order that the metals precipitable by the zinc may separate. Filter at the end of 24 hours, and the solution is ready for use; each portion of zinc dissolved corresponds to about 2·1 parts of chloride of zinc. The sulphate of nickel should also be as pure as possible, and the cold solution should not precipitate when a plate of iron is plunged in it, as would happen, for example, if it contained copper. When during the operation the liquor becomes a pale green, owing to the precipitation of nickel, more sulphate must be added until the intense green is regained. When the used liquid is exposed to the action of the air, it deposits hydrated oxide of iron, coming from the dissolved metal. It should be filtered, and more chloride of zinc and sulphate added, when it may be again used. In the same way, polished iron and steel objects may be covered with a brilliant plating of cobalt, by using a sulphate of cobalt solution. The appearance of this plating differs little from that of polished steel. The distinguishing characteristic is the light rose-colored tint. The author states that the plating wears well.

Glycyrrhizin.

The word "glycyrrhizin" is the name applied to the active principle of the licorice root, which bears the botanical name of *glycyrrhiza glabra* and *g. echinata*. It has usually been described as an amorphous, yellowish-white powder. Habermann has succeeded in preparing from the commercial article sold by Trommsdorff, by treating it with a considerable quantity of glacial acetic acid, an almost colorless substance, which crystallizes from alcohol in prismatic needles which usually form hemispherical masses. This substance is extremely soluble in water and in strong alcohol, less soluble in absolute alcohol, and as good as insoluble in ether. It has an intensely sweet taste, with an irritating after-taste, and in many of its properties corresponds remarkably with glycyrrhizin as described by Gorup-Besanez in 1861. An alcoholic solution of this with an alcoholic solution of calcium chloride gives a white flocculent precipitate, and a similar precipitate is obtained by mixing an alcoholic solution of glycyrrhizin with one of sugar of lead. When the crystallized glycyrrhizin is boiled with water containing 2 per cent of sulphuric acid, a solid resinous substance of a light Isabella yellow color separates, which, however, differs from that described by Gorup-Besanez in having the characteristic sweet taste of glycyrrhizin. The amount of carbon in the crystalline substance differs by several per cent from that in the substance described by Gorup-Besanez. Habermann is continuing his investigation of the new substance and its derivatives.

Dyeing Loose Cotton.

The working up of cotton and wool into all sorts of fabrics has of late years received much development, so that now 25 to 30 per cent of loose cotton may be added to wool, and the fabrics so woven actually deceives the naked eye of the experienced dealer; the only difficult point is to dye the cotton well and fine. It may, therefore, be interesting to quote a cotton-dye method which has been found to answer the purpose well.

With fabrics that do not require to be fulled, all colors can be produced to resemble the tints of wool. The loose cotton, as it proceeds from the ball, may be loosed either by mechanical or manual labor, and as soon as each raw cotton yarn has been boiled two hours in water, it is ready for dyeing; but that manipulation may be saved in most colors by immersing the cotton: as, for example, for black, into a logwood bath for two hours, by which time is saved. The chief thing to attend to during the boiling process is to turn the cotton incessantly, so as to insure that all portions may be soaked through, otherwise non-dyed white spots would show up. It is also advisable to use separate vats for each bath, by which much dye material may be saved, as the subsequent baths then require less fresh dyestuffs or salts; if the baths have, however, been used several times, or are broken or thick, of course fresh baths have to be prepared and the old ones cleaned out.—*Textile Manufacturer.*

Desiccated Eggs.

It is already well understood that if albumen or white of egg be slowly dried in mass, or be dried rapidly at too high a temperature, a product or material will be the result which is of inferior and not uniform character or quality. Also, that if the yelk of eggs be dried in mass, slowly or rapidly, the result will be a material or product inferior in quality, not uniform in structure, difficult of solution, and of little value for the ordinary uses of the yelk of eggs. If batter of eggs composed of the whites and yelks together be dried in mass, the result lacks uniformity and solubility; and if either of these products, so obtained, be subsequently ground or pulverized, by any known process, the mealy result so obtained is of inferior quality, is slow of solution in water, and does not possess several of the important properties of the fresh shell eggs.

To meet this difficulty, the idea of the desiccation of eggs in rotation or agitation under blasts of air, either heated or otherwise, has been variously applied during a long time past, both in this country and in Europe, but the difficulty mainly encountered has been that of producing a material capable of being preserved in different climates, of being readily and completely dissolved, and of being applied to the principal uses and purposes for which the egg may be applied before desiccation.

The natural egg contains, in varying proportions, a certain oil, hereinafter spoken of as the oil of the egg. This oil is a very important constituent of the egg. It is innocuous while in its natural condition—that is, in undisturbed combination with, or relation to, the other parts of the organism of the egg, its proportion thereto being relatively small.

When, however, this oil is set free by any process, it rapidly becomes rancid, highly offensive, and, in fact, acrid, and is a most potent and active agent in effecting the deterioration and decomposition of the other parts of the egg with which it may be brought in contact.

If, during the process of desiccation, the material to be desiccated is allowed to rise in temperature above a certain point, hereinafter indicated, the oil of the egg contained in the more solid parts, or which is not in suspension or emulsion, but is in more perfect combination with the other constituents of the egg, particularly that in the yelk, and so in the batter composed in the yelks and whites, is set free to a greater or less extent, according to the freshness and vitality of the eggs used and the degree of such heat. It has also been ascertained, by experiment, that the temperature at which this result follows varies at different times. The causes apparently depend upon barometric and other conditions of the atmosphere as well as the state of the thermometer. Such a result has usually followed whenever the material has been raised above 85° Fah. The highest temperature to which Mr. W. O. Stoddard, of New York city, who has made a special study of this subject, has been able to subject the material without that result following was 92° Fah.; but that was under exceptional atmospheric conditions, and he considers a much lower temperature than 85°, and, if possible, than 80°, very desirable for safety, and essential to commercial success in the manufacture. Indeed, his own operations have been conducted at a temperature not to exceed 80°.

Mr. Stoddard has lately patented (May 8, 1877) a device, the object of which is to regulate and control the temperature of the eggs, or parts of eggs, or batter of eggs, or other material during the process of desiccation, so as to prevent the development or freeing from the more solid part of such material of the oil of the egg not held in suspension or emulsion, being much the larger part of all the oil contained in the egg, and afterward to eliminate from the product derived such small portions of the oil of the egg as may have been held in suspension or emulsion, or may have been set free in the process of manufacture. The granulated or mealy product which thus obtained will then, he claims, retain and protect its proper proportion of the oil of the egg, even if exposed to a much higher temperature than that above mentioned.

To obtain the object thus substantially set forth while employing for the process of desiccation a drying blast of warm air, he employs for the rotating surface, on which such desiccation is produced, a hollow cylinder, cone, frustum of a cone, or other surface which may be artificially cooled by means of ventilation or evaporation in the interior while the material within is actively agitated.

Employment of a New Salt of Iron for Steeling Copper Plates for Engraving.

The electrolytic deposit of iron on copper presents—as the author has shown thirty years ago—a great hardness, which equals at least that of steel. The salt generally employed for producing this deposit is double sulphate of iron and ammonia. The following solution seems to be more advantageous for this operation: We dissolve 155 grains of ferrocyanide of potassium and ¾ oz. of salt of seignette in 7 ozs. of distilled water, and we add to it 45 grains of ferric sulphate, dissolved in 1¾ ozs. of water; a precipitate of Prussian blue is thus produced. We add then, drop by drop, whilst stirring, caustic soda, until the precipitate is re-dissolved. We thus obtain a limpid yellowish solution, which is used for steeling copper. This same solution may serve to dye tissues blue without a mordant. For this purpose, after their immersion in the bath, we let them dry in the air; then we plunge them into a solution of sulphuric acid at 2°; we wash and dry them.—*M. R. Boettinger, in Chemisches Centralblatt.*

Wool Bleaching.

It has been found that the method of bleaching wool by means of oxalic acid, combined with glycerin, or used alone, has the effect of causing the fibers of the wool to become felted. This is now remedied by saturating the oxalic acid with soda, potash, or ammonia, thus forming a soluble oxalate. The bleaching is effected in the same manner, that is to say, with pure water, exempt from lime, and the wool preserves all its suppleness and soft touch.

Fast Railway Trains.

The New York Central and Hudson River Railroads and the Pennsylvania Railroad are now running fast trains between New York city and Chicago. The time allowed is about 24½ hours, the distance about 980 miles in each case. Taking these figures as a basis, a speed of 40 miles an hour, including stoppages, has to be maintained. The Chicago *Inter-Ocean* hints this speed is too great for safety, and asserts that passengers prefer to go by slower and safer trains.

JOHN W. EVARHART, of Marion county, Va., chopped down a chestnut tree the other day that contained 31 gallons of nice honey a distance of 10 feet from the butt. He afterwards made 600 rails and 1,000 shingles out of the tree.

PARA-ARABIN.—Professor E. Reichardt says that this substance, $C_{12}H_{22}O_{11}$, is obtained from the tissues of the sugar beet or the carrot after the juice has been expressed. It gelatinizes with water, and dissolves completely on the addition of a little acid and the application of a gentle heat.

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London Water Pipes.

The first instance on record of water being conveyed to the city of London by means of pipes is in the year 1236. Before this time, according to Maitland, the city and places adjacent were supplied by the "river of wells," in the west part; whose decay was owing to certain mills erected on the banks thereof by the Knights of St. John, which obstructed its navigation, and by degrees gave it the name of Turnmill Brook, a name which is still preserved in Turnmill street, through part of which this water took its course towards the bottom of Holborn Hill, and thence into the Thames between the Fleet and St. Bride's. In process of time, Turnmill Brook was lost in the name of Fleet Ditch, or Fleet Dyke.

The other waters were Olborn or Holborn, Wall Brook, and Langbourn. Besides these bourns or brooks were several springs which supplied the city, as Holywell, a fine spring famed for its miraculous virtues in superstitious times; Clerk's or Clerkenwell, Skinner's Well, Fogg's Well, Tod's Well, Loder's Well, Crowder's Well, and Rad-Well, and the Horsepool or Horsepond in Smithfield. These several springs, or most of them united their streams, and formed the "river of wells" before mentioned.

In the year 1236, in consequence of a great want of water prevailing in London, occasioned principally by the encroachment of buildings and the Mills of the Knights of St. John, before referred to, on the fresh water canals about the outskirts of the city, many opulent citizens contributed liberally to the inauguration of a scheme for bringing water by means of main pipes from six fountains in the neighboring town of Tyburn, and this product was eventually carried into execution.

Hug h Myddelton, a worthy and enterprising citizen, carrying on the business of a goldsmith, who, after several others had attempted it without success, put into execution the design of supplying London with water for domestic use, by means of a river cut through the country from Chadwell and Amwell, near Ware, in Hertfordshire, to a basin or reservoir near Islington, on the north side of London. This work was begun on February 20, 1608, "and with great difficulty, art, and industry, and a prodigious expense," with the assistance of King James I., was completed, and the water let into it, on Michaelmas day, 1613. The source of the New River is twenty miles from London, but the measurement of the original stream, followed throughout its devious windings, necessary to preserve its level, and to some extent, also, owing to the stubborn opposition of certain of the landed proprietors, was 48 miles 3 quarters and 16 poles. Its length has been reduced, at different times, to about 28 miles, by cutting off the loops. On the completion of the work, Mr. Myddelton was knighted, and afterwards created a baronet. The stupendous undertaking eventually produced immense profits to the fortunate proprietors of its shares, but the original projector was all but ruined by the expenses he incurred in bringing it to a conclusion.

The successful completion of the New River marked an era in the history of the science of engineering in England; and the abundant supply of one of the chief necessaries of life, which it afforded to the population of the metropolis, led to the development of the method of conveying water by means of pipes to the doors and into the dwellings of the inhabitants.

The main pipes used at that early day were sheet lead, turned on a mandrel, and soldered at the edges, and the trunks of elm trees, bored with augers, and left in their natural undressed condition outside. Other water companies were established in the course of time, till at the present day there are eight of these supplying London from various sources.

Gas began to be supplied through pipes in 1807.

French Workmen at the Exposition.

Ten thousand dollars have been appropriated by the Commissioners of the Paris Exposition of 1878 in aid of artisans who have meritorious objects to exhibit, constructed by their own hands, and who are working for their own account, but who are unable to defray the expense of exhibition from their own resources. The prefects of each of the 86 departments are to supervise the applications under this head.

THE royal tigress in the Berlin Zoological Gardens lately brought forth a litter of two, which she utterly refused to take care of. They were accordingly placed amidst the family of a Newfoundland dog, who welcomed the newcomers warmly, and bestows upon them all necessary maternal attentions.

DECISIONS OF THE COURTS.

United States Circuit Court—Northern District of Illinois.

TRUNK PATENT.—HERMAN VOGLER *vs.* EDWARD SEMPLE.

[In equity.—Before Blodgett, J.]

The claim in a patent must be for something described in the specification, so that any person of ordinary mechanical skill, or skill in the art covered by the patent, can, from the specification, make a mechanism which will contain the claim.

The purpose of a reissue is to enable one to secure what he was entitled to in his original patent, but, through inadvertence or mistake, did not obtain; but it cannot be made the means of covering anything which was not in the original invention.

The novelty of a patented invention is not impeached by a prior patent which did not originally describe the invention, but has since been enlarged by reissue so as to include it.

Any device which secures substantially the same results as the patentees by the same or equivalent mechanism, is an infringement.

This is a bill in equity for an injunction, and an account of profits and damages for an alleged infringement of a patent granted by the United States to the complainant, January 11, 1867, for an "Improvement in Trunks," being a reissue of an original patent to the same substantial purport, dated October 6, 1874.

The answer denies the infringement, and also denies that complainant is the original and first inventor of the device set forth and claimed as new in his original and reisued patent.

Complainant's patent is for a removably hinged tray in the body of a trunk; the parts being so arranged and combined as to admit of the ready removal of the tray from the trunk, and yet so adjusted as to allow the tray to be turned up on its hinges, into, or against, the cover or top. This is accomplished by the peculiar form of the hinge—one leaf of which is permanently fastened to the tray, and the other so arranged as to be inserted in sockets, which are firmly fixed to the back wall of the trunk; the whole being so arranged as to admit of a ready removal of the hinged tray from the trunk, and so adjusted as to allow it an up-and-down play. * *

The Court held that any device which secures substantially the same results as complainants, by the same or equivalent mechanism, is an infringement on complainant's patent. The defendant does not use Vogler's strap hinge and socket, but in place of it he uses a hook and socket, or roller and socket—not the pintle and socket of Plumer, but a hook attached to the back wall of the trunk, and a roller fastened to the back and upper edge of the tray, so as to engage with and rest upon the hook, the two when in juxtaposition making a hinge which performs the substantial functions of complainant's hinge, except that for lack of the elongated strap it is more readily disengaged: but when the parts are together, it operates in all essential particulars as the equivalent of complainant's strap hinge. I am, therefore, of opinion that defendant's tray is, in all its material features as a removably hinged tray, an infringement of complainant's patent. * * *

Decree for the complainant.

[*Munday and Evarts*, for complainant.
N. C. Gridley, for defendant].

NEW BOOKS AND PUBLICATIONS.

TROW'S NEW YORK CITY DIRECTORY, for the year ending May 1, 1878. Price, $5.00. New York city: The Trow City Directory Company Publishers, 11 University Place

This is the ninety-first volume of this standard publication. It contains, we are told in the preface, 248,690 names, showing an increase of 7,253 over last year, and (estimating each name to represent five persons) an advance in population of the metropolis of 37,615. The work has been carefully compiled; and large as it is, equalling in printed matter, the publishers says some thirty volumes of the ordinary novel, has been entirely prepared and published since the 1st of May The usual excellent map of the city is provided; and in general the work is fully up to its normal standard of excellence.

THE AMERICAN MAIL.—This is the title of a new and handsomely printed monthly publication devoted to trade purposes, especially designed for foreign circulation. It exhibits the latest quotations in all the different branches of trade, shows productions of the country, its manufactures, and the advantages which the American market affords in the way of supplies for foreign places.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED MORTISING MACHINE.

Alfred D. Eddy and Henry J. Stolzenbach, Tiffin, O.—This invention is an improvement in that class of mortising machines in which the boring and cutting tool is caused to advance as the table carrying the stuff to be mortised is reciprocated in a direction at right angles thereto. The improvement relates to the device for clamping the stuff upon the table; the circular form of the work table, the adjustable bracket on which the work-table slides, the means for reciprocating the mandrel, the construction of the cam periphery, and a belt-tightening device.

IMPROVED APPARATUS FOR ATTACHING HARNESS TO THE SHAFTS.

William C. Smith, New Haven, Conn.—This is intended for the purpose of hitching quickly a single horse to any vehicle having shafts, or for hitching a double team, using two pairs of shafts, instead of a pole, the object of the device being to save time, so as to be specially adapted for hose carts, fire engines, and similar apparatus. It consists of a socket, with open top and spring-acted locking dog, applied to the harness, and of a button that enters the socket and is connected by loosely swinging link and trace piece to the shaft and trace.

IMPROVED RUNNING GEAR.

Moses Atwood, New Sharon, Iowa.—This running gear is so constructed that either of the wheels may rise above or sink below a level in passing over obstructions or depressions without straining the gearing or body.

IMPROVED SAWING MACHINE.

Flavel Simonson, Round Grove, Ill.—The operation of the machine is as follows: The guide is raised by a handle until it is engaged by a catch. A log is placed against the serrated plates and securely clamped by the dog by drawing a lever, the said lever being held in place by a ratchet bar. The guide is now released from the catch, and lowered until the saw comes into contact with the log, when, being in motion, it cuts its way through the log, being forced downward by the weight of the saw frame. When the log is cut through, the guide prevents it from dropping too low.

NEW HOUSEHOLD INVENTIONS.

IMPROVED INVALID BEDSTEAD.

Charles T. Moore, Renovo, Pa.—This is a bedstead for invalids which can be adjusted in various positions for the convenience and comfort of the occupant.

IMPROVED BURGLAR ALARM.

Hiram J. D. Miner and Daniel T. Seeley, Dunkirk, N. Y.—This is an alarm for attachment to doors and windows, which will indicate the opening of the same by releasing a spring-actuated train of gearing, which rings a bell. The movement of a lever attached to the door or window liberates an arm, and permits the gearing to act on the pallets and vibrate the hammer, which strikes a stud, causing the bell to ring.

IMPROVED WINDOW CORNICE.

Samuel Sargeant, Brooklyn, N. Y.—This consists in an improved window cornice, formed by attaching horizontal metal tubes and vertical metal tubes halved to each other, and provided with knobs in some or all of their ends, to foundation boards by screws passing through the said boards, through the inner sides of the said tubes, and into blocks of wood driven into the tubes.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ICE PLOW.

John F. Behm, Omaha, Neb.—This is an improved ice plow by which two furrows may be cut, and which may be used in either direction without turning the plow, the same marking also closer or wider, as required. The plow has cross-pieces, to which two longitudinal rows of cutters are attached, that are arranged symmetrically to a center cutter, and decreasing in height toward the end cutters. The handles are attached to a centrally pivoted beam that may be swung around to use the plow in either direction without turning the same.

IMPROVED TOY MONEY BOX.

Edward J. McLoughlin, New York city.—The shaft of a winged wheel extends through the side of the bank, and is provided with a flexible index, which touches a circular row of pins that project from the face of a dial at the front of the bank. The coin is dropped into a chute, whence it passes to the wheel, and by striking one of its wings causes it to rotate. This motion continues until arrested by the friction of the journals and the resistance of the index as it passes the pins. A number is called, and if the index stops at the number mentioned the bank pays five times the amount of the deposit, which is retained, but if the index stops at any other number than the one called, the bank retains the deposit and pays nothing.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED GOVERNOR FOR STEAM ENGINES.

Harris Tabor, Corning, N. Y., assignor to B. W. Payne & Son, of same place.—This is an improved governor for steam engines, which acts in the customary manner when applied to an engine with single valves, and also as an automatic cut-off. When the speed increases over that required by the tension spring, weights are thrown out by centrifugal force, and the eccentric moved across the shaft, thereby reducing the travel of the valve until the engine is brought back to its former speed. If there is a tendency to decrease the speed the spring draws the eccentric in opposite direction, so as to impart a longer stroke to the valve and re-establish the required speed. The joint action of the tension spring and weighted levers on the sliding eccentric serves to keep up the uniform motion of the engine, according to the degree of speed to which the spring has been adjusted.

IMPROVED HEATING FURNACE.

Stephen W. Morgan, Winona, Minn.—This furnace saves fuel by means of reheating the smoke and passing the same again through a series of radiating pipes or drum. The invention consists, mainly, of a fire box with a system of horizontal pipes extending therefrom, and returning to a reheating box placed centrally in the fire, the gases of combustion being there reheated and conducted through a second system of heating pipes, and finally out to the chimney.

IMPROVED SAFETY VALVE.

Frank B. Scovell, Waterford, Ontario, Canada.—The steam is admitted to the space in a cylinder above a piston. The said piston being greater in area than the valve, the counter pressure exerted on it is more than sufficient to hold the valve to its seat. When the pressure of steam rises above the prescribed limit, a piston in the valve is forced upward against the pressure of a spring carrying a small sliding valve with it, so that it covers ports. The steam above the piston is thus permitted to escape when the valve is raised by pressure of steam from below, and steam escapes from the boiler until the normal pressure is regained, when the spring throws the small piston downward, moving the sliding valve, admitting steam to the space in the cylinder above the piston, when the steam so admitted will force down the piston, and cause the valve to regain its seat.

IMPROVED MACHINE FOR SANDING BRICK MOULDS.

Samuel W. Babcock, Haverstraw, N. Y.—To a shaft are attached rows of paddles, the different rows being set at a different lateral inclination. The shaft is revolved by a belt passing around a pulley attached to its end, and as it revolves the paddles take the sand from a box and project it through the slotted top of the table into the inverted moulds standing upon said table beneath the platform. A hopper having its bottom inclined from the middle to a hole on each side is connected by spouts with the apertured sand box, to enable the sand to flow automatically from the former into the latter.

IMPROVED TOOL HANDLE.

Levi H. Roberts, Morley, Mich.—The end of the handle is cut off about half an inch within the eye of the tool, and in the part of the said handle that enters the said eye is formed a transverse mortise, in which is loosely fitted a nut. In the end of the handle is bored a longitudinal hole to receive the bolt, the forward end of which is made conical. A plate, made a little larger than the eye of the tool, is rabbeted upon its inner side, to allow its middle part to enter said eye, and upon its inner side and upon the opposite sides of the hole for the bolt are formed two wedges. Slits are sawed in the end of the handle to receive the wedges. To the bolt is secured a collar. This arrangement allows the bolts to be started a little before it begins to withdraw the plate and wedges, so that should the said plate and wedges stick, they may be started by means of a chisel, or other suitable instrument.

IMPROVED MARINE ENGINE GOVERNOR.

William A. Brice, London, England.—This is an improved means of governing the speed of marine engines, to prevent what is known as "racing," when the screw is momentarily raised out of the water. The device consists in a centrifugal governor, of any suitable construction, driven by toothed gear direct from the screw shaft, and operating a throttle valve of any kind in one of two steam pipes, by which steam is supplied to the engines. Where one pipe has been used before to convey steam from the boiler to the engines, two pipes are used, and in one of them is applied a valve operated by the governor, as above described, so that immediately the screw commences to turn at a higher speed the valve will be closed, and the steam cut off through that pipe. If the sectional areas of the two pipes be equal, half the steam supply is thus cut off, the other half through the other pipe being intended to keep the engines in motion at the same speed.

NEW AGRICULTURAL INVENTIONS.

IMPROVED RECIPROCATING CHURN.

Eliza Brough, Greenville, Mich.—By suitable construction, as the churn body is oscillated upon its pivots, the milk is dashed back and forth, and is thrown into violent agitation, bringing the butter in a short time.

IMPROVED CATTLE STALL.

Ephraim E. Waddell, Gallipolis, O.—This consists in the combination, in a cow stable, of a frame, pivoted side gates, cross beam, and floor steps, the gates being pivoted in cross beam and steps, and between the front and rear ends of the stalls.

IMPROVED PLOW.

John D. Bowen, Roseburg, Oregon.—The invention consists in a share land-side and land-side share made in one piece, cut out of sheet steel struck up into proper shape, or cast of cast steel, and provided with lugs and a slot for the attachment of other parts of the plow. The whole may thus be made of less material, lighter, and cheaper, the shares being self-sharpeners.

IMPROVED MOWER.

James H. Cain, Cana, N. C.—When the cutter blades are thrown into downward position by the lever, they are rigidly braced by a rod and retained in position for work by a hook, binding on a lever, so as to be operated by the reciprocating motion of the cutter bar as imparted by the gearing of the wave wheel with the main wheel. The swinging up of the cutter blades interrupts the gear of main wheel and wave wheel by joint action of levers, and gives, in this manner, to the attendant a full control over the mower.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Pattern Makers can get Metallic Pattern Letters, to letter patterns, of H. W. Knight, Seneca Falls, N. Y.

Wanted—Quantity large coiled Springs. Miller, Barlow & Co., Cookshire, Quebec, Canada.

West's New Yankee Tire Setter. Sets them cold on the wheel. Shrinks all around alike. J. B. West, Rochester, N. Y.

Wanted—A new 50 horse Engine and Boiler. Engine of latest style. Combining simplicity and economy. Enquire of A. M. Johnston & Co., Rockford, Ill.

Manufacturers of Felt Paper send samples and prices, by quantity, to S. T. Carr, Elmira, N. Y.

For Sale.—One Spinning Lathe. Good as new. Address White Sewing Machine Co., Cleveland, O.

Wanted—Burglar Alarm. Box 111, Saratoga Sp's, N.Y.

One third-class Amoskeag Steam Fire Engine built to order and highly finished, to be drawn by hand or horse, fully equipped with hose carriage, hose, pipe, and tools; engine was never in service, and can be seen at Rhode Island Locomotive Works, Providence, R. I.

Inventors.—All patents not received before June 25th must hold over until September Sale. G. W. Keeler, Auctioneer. See Advt.

A Device for Preventing the Accumulation of Frost and Steam upon Store Windows has been patented by C. T. Anthony and J. Manheim, of Taunton, Mass., to whom all letters should be addressed. Territory for sale.

Reliable Oak Leather and Rubber Belting. A specialty of Belting for high speed and hard work. Charles W. Arny, Manufacturer, Phila., Pa. Send for price lists.

How to make Violins—Write J.Ranger,Syracuse,N.Y.

Shaw's Noise-Quieting Nozzles, for Escape Pipes of Locomotives, Steamboats, etc. Quiets all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For 13, 15, 16, and 18 in. Swing Screw-Cutting Engine Lathes, address Star Tool Company, Providence, R. I.

For Sale.—Second-hand 4 Sided-Moulder, with about 300 knives; good as new; price $500. T. R. Bailey, Agt., Lockport, N. Y.

Combined Miller and Gear-Cutter; capacity large; almost new; a bargain. C. A. Conde & Co., Phila., Pa.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood working machinery, address B.C. Machinery Co., Battle Creek, Mich.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Steel and Iron Set Screws, manufactured by L. F. Standish & Son, New Haven, Conn.

Electric Gas Lighting Apparatus, applied to public and private buildings. The latest improvements. A. L. Bogart's patent. Address 702 Broadway, N. Y.

Patent Taper Sleeve Fastening and Wooden Pulley Works are now in full operation. Orders solicited. Satisfaction guaranteed. A. H. Gray, Erie, Pa.

Painters, etc., get circular, prices, etc., of New Metallic "Wiping out" Graining Tools; 75,000 now in use. J. J. Callow, Cleveland, O.

Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 49 Cortlandt St., N. Y. Experimental work.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Solid Wrought iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Small Fine Gray Iron Castings a specialty. Warranted soft and true to patterns. A. Winterburn, 16 and 18 De Witt St., Albany, N. Y.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Best Glass Oilers. Cody & Ruthven, Cincinnati, O.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 414.

Help for the weak, nervous, and debilitated. Chronic and painful diseases cured without medicine. Pulvermacher's Electric Belts are the desideratum. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 292 Vine St., Cincinnati, Ohio.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Oval and Disk Cutting Machines for Lithographers, Printers, Paper Box Manufs., etc. Send for illustrated circular. Frank Thomas & Co., Home St., Cincinnati, O.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence. R. I.

Notes & Queries

S. S. will find something on desiccating eggs on another page of this issue.—J. T. W. will find a recipe for aquarium cement on p. 80, vol. 31.—J. P. M., Jr., will find on p. 123, vol. 29, directions for making a storm glass.—Mrs. J. G. B. is informed that galvanized pipes and vessels are very deleterious to water. See p. 139, vol. 33.—R. W. S. will find something on regulating the heat of an incubator on p. 273, vol. 33, and p. 213, vol. 34.—A. R. S. should read the answer on p. 396, vol. 36, as to moulding in plaster of Paris. As to cleaning carpets, see p. 89, vol. 25.—P. M. B. will find on p. 395, vol. 36, directions for removing oil stains from granite.—J. E. M. will find directions for bluing steel on p. 123, vol. 31.—D. H. B., of Aby-Thorshag, Sweden, is informed that we do not know the address for which he inquires.—L. B. will find the description of high and low pressure engines on p. 42, vol. 25. As to the rule for horse power, see p. 33, vol. 33.—B. Y. can try the preparation described on p. 154, vol. 32, to preserve his silver objects from being tarnished.

(1) C. W. B. asks: 1. How can I make hair rope fireproof? A. Strong, warm solutions of tungstate of soda (crude), or of sulphate of soda (Glauber salt), in water may be used for this purpose. It is not necessary to repeat the tungstate of soda treatment unless the material has been exposed to continued wet weather, in which case it is recommended to precipitate the insoluble tungstic acid in the fiber by soaking it, after impregnation, in diluted muriatic acid. The sodium chloride (salt) formed should be dissolved out with warm water. For hair ropes, it would be best to pass the material through a bath of warm alkali before impregnating with the tungstate. 2. Does the process make it heat-proof? A. We do not know what is meant by "heat-proof." Impregnating the ropes with inorganic salts will much alter its heat-conductivity.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

O. B.—No. 1 is not a lithographic stone, and would be of little value for lithographic purposes. It might answer for rubbing down rough metal, and in marble polishing. It is too soft and porous to make a good hone. No. 2 is a limestone; and if properly burnt, it might make a cement.—D. E. W.—The mineral contains (besides carbonate of lime) crystals of barite and celestite. You should send a larger piece.

A. I. asks: Has there been anything invented to throw a paddle wheel off of its center? Many such wheels, and stationary engines also, stop in the dead center, and have to be pried off before they can start again.—W. G. B. asks: How is the low temperature produced and maintained in the refrigerators on exhibition at the Centennial? I noticed that the thermometers in them showed about 20° Fah.—C. L. P. asks: Will C. H. S., who uses coal oil to make his hair grow, inform me how he applied the oil, how often, and how much at one time, and whether he washed or bathed his head with water?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a New Motor. By W. B. M.
On Steam Economy. By J. W. T.
On Torpedo Balloons. By T. F.
On a Fire Escape. By W. C. M.

Also inquiries and answers from the following:

J. D. H.—F. J. B.—J. B. M.—W. H.—J. B. B.—G. G. J. H. W.—A. A. A.—H. S.—G. F. K.—J. B.—C. A. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells the best boiler scale preventive? Who makes imitation marble? Who sells glazed porcelain tiles? Who sells iron stable fittings? Who sells aquaria, with fish, reptiles, and suitable plants? Who sells astronomical telescopes?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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May 22, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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9,992.—TYPES.—W. F. Capitain, Chicago, Ill.
9,993.—CLOCK FRAME, ETC.—H. J. Davies, Brooklyn, N. Y.
9,994 to 9,997.—CARPETS.—J. Hamer, Dutchess Co., N. Y
9,998.—RUGS.—J. Hamer, Dutchess county, N. Y.
9,999.—CARPETS.—J. Hamer, Dutchess Co., N. Y.
10,000.—PUMPS.—O. Heinigke, New York city.
10,001.—SHOES.—G. W. Meader, Woonsocket, R. I.
10,002.—CARPETS.—J. Neil, New York city.
10,003.—LACE FABRIC.—J. Robinson, Brooklyn, N. Y.
10,004.—CARD RACKS.—P. Rosenbach, New York city.
10,005.—CARPET.—T. J. Stearns, Boston, Mass.
10,006.—DIRECTORY BOARDS.—W. H. Thackeray, Pittsburgh, Pa.
10,007.—METAL BOXES.—W. Wilkinson Phila., Pa.
10,008.—CASTERS.—A. H. Wirz, Philadelphia, Pa.

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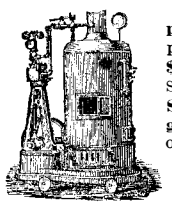

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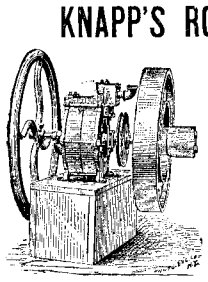

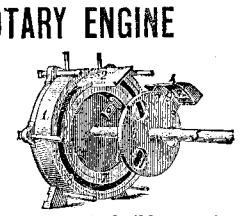

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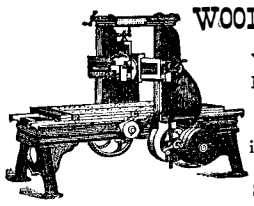

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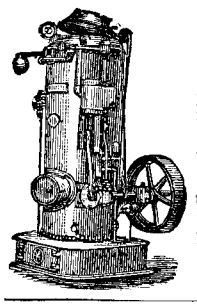

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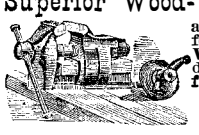

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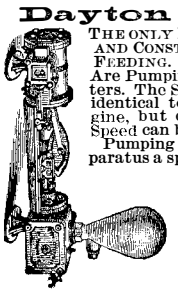

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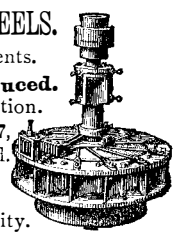

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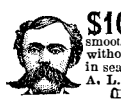

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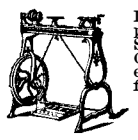

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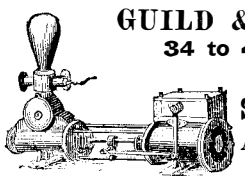

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